

DOCUMENT RESUME

ED 235 377

CE 037 295

AUTHOR Stadt, Ronald; And Others
TITLE A Catalog of Performance Objectives, Performance Conditions, and Performance Guides for Machine Tool Operations.
INSTITUTION Illinois State Board of Education, Springfield. Dept. of Adult, Vocational and Technical Education.; Southern Illinois Univ., Carbondale. Dept. of Vocational Education Studies.
PUB DATE Oct 83
NOTE 325p.
PUB TYPE Guides - Non-Classroom Use (055)
EDRS PRICE MF01/PC13 Plus Postage.
DESCRIPTORS *Behavioral Objectives; *Equipment; *Evaluation Criteria; Hand Tools; Job Analysis; Machinery Industry; *Machine Tool Operators; Machine Tools; *Machinists; Metal Working; *Occupational Information; Performance Factors; Performance Tests; Postsecondary Education; Secondary Education; Specifications; Task Analysis; Vocational Education

ABSTRACT

This catalog provides performance objectives, tasks, standards, and performance guides associated with current occupational information relating to the job content of machinists, specifically tool grinder operators, production lathe operators, and production screw machine operators. The catalog is comprised of 262 performance objectives, tool and equipment lists, and performance guides that were prepared from job-related task statements from the occupational inventory. Each performance objective contains the condition under which the student will perform the objective, the performance required of the worker in the job environment, and a job-relevant standard for measuring successful performance of the objective. The source of the standard for each objective is documented. The tool and equipment list includes the required tools and equipment for completing the performance guides. Accessories included are the necessary tools and machinery parts used with a basic machine. The performance guides that accompany the tasks provide procedural steps identified as subordinate to task performance. Appendixes to the catalog contain cross-reference tables of duties and tasks of machine tool operators; percentages of workers using tools, equipment, and work aids; references; and a model of the process of the development of the catalog. (KC)

 * Reproductions supplied by EDRS are the best that can be made *
 * from the original document. *

168313302

ED235377

A CATALOG OF PERFORMANCE OBJECTIVES,
PERFORMANCE CONDITIONS, AND PERFORMANCE GUIDES
FOR
MACHINE TOOL OPERATIONS

Prepared by

Dr. Ronald Stadt
Project Director

Dr. Fred Reneau
Project Co-Director

Dr. Bruce McDonald
Project Co-Director

Dr. Eugene Sanders
Curriculum Specialist

Department of Vocational Education Studies
College of Education
Southern Illinois University
Carbondale, Illinois 62901

and

Department of Adult, Vocational and Technical Education
Illinois State Board of Education
Springfield, Illinois 62777

U.S. DEPARTMENT OF EDUCATION
NATIONAL INSTITUTE OF EDUCATION
EDUCATIONAL RESOURCES INFORMATION
CENTER (ERIC)

This document has been reproduced as
received from the person or organization
originating it.
☐ Minor changes have been made to improve
reproduction quality.

• Points of view or opinions stated in this docu-
ment do not necessarily represent official NIE
position or policy.

October 1983

PERMISSION TO REPRODUCE THIS
MATERIAL HAS BEEN GRANTED BY

C. Reisinger

TO THE EDUCATIONAL RESOURCES
INFORMATION CENTER (ERIC)."

037295

TABLE OF CONTENTS

ACKNOWLEDGEMENTS	i
INTRODUCTION	1
DEFINITION OF TERMS	2
PURPOSE OF THE CATALOG	4
DEVELOPMENT OF THE CATALOG	4
Preliminary Research	5
Description of the Sample	5
Analysis of Data	5
The Writing Team	6
The Field Review	6
ELEMENTS OF THE CATALOG	7
PERFORMANCE OBJECTIVES, PERFORMANCE CONDITIONS, AND PERFORMANCE GUIDES	9
APPENDIX A - Cross Reference Table	273
APPENDIX B - Tool, Equipment and Work Aids List	302
APPENDIX C - State of the Art Bibliography	318
APPENDIX D - V-TECS Developmental Model	319

ACKNOWLEDGEMENTS

Gratitude is extended to all who helped prepare, edit, and review this catalog, especially the following people who contributed their time, effort, and expertise:

David Dimmlich (Machine Shop Instructor)
Stephenson Area Vocational Center
Freeport, Illinois

Velda Gerstenecker (Employment Analyst)
Bureau of Labor Statistics
Job Service
Belleville, Illinois

Michael Goodrich (Machinist)
Ehrhart Tool and Machine Company
Granite City, Illinois

Dr. Paul Greenwood (Lathe Operator)
Stage Aviation
Belleville, Illinois

Rollie Isselhardt (Screw Machine Operator)
Century Brass Works, Inc.
Belleville, Illinois

Don Koleson (Vocational Program Coordinator)
Belleville Area College
Belleville, Illinois

Joseph Kutosky (Machine Shop Instructor)
Granite City High School
Granite City, Illinois

Vicky Oliver
Illinois Occupational Information Coordinating Council
Springfield, Illinois

Jack Peters (Shop Supervisor)
Highland Machine and Screw Products Company
Highland, Illinois

Jim Quinn (Shop Supervisor)
East Side Tool and Die Company, Inc.
Fairview Heights, Illinois

Chris Reynolds (Statistician)
Department of Commerce and Community Affairs
Springfield, Illinois

Lewis Whitsell (Shop Supervisor)
Ehrhardt Tool and Machine Company
Granite City, Illinois

INTRODUCTION

The Vocational-Technical Education Consortium of States (V-TECS) is a cooperative venture of twelve states and four technical training departments of the armed forces for the purpose of developing catalogs of performance objectives and performance guides in occupational education through the sharing of resources and technology. The V-TECS member states are Alabama, Florida, Georgia, Illinois, Kentucky, Maryland, Missouri, Pennsylvania, South Carolina, Tennessee, Virginia, and West Virginia. The Air Training Command of the U.S. Air Force, the Naval Education and Training Command of the U.S. Navy, the U.S. Marine Corps, and the U.S. Army hold associate membership in the consortium..

All products are developed within the member states using a uniform procedure and format in order to ensure confidence in the products and promote transportability between states. The major components of the procedure are: (1) review of relevant literature, (2) development of task listings by a domain of job titles, (3) comprehensive interviewing of job incumbents for the purpose of further development, refinement, and validation of the task listing, (4) selection of a representative random sampling of incumbent workers from the population of workers within the state which is developing the catalog, (5) administration of the occupational inventory to the sample of incumbent workers, (6) computer analysis of data collected from the sample of workers, (7) conversion of job-relevant task statements into performance objectives, listing tools and equipment, and writing performance guides, (8) comprehensive

field review of the catalog, (9) analysis of data from the field review, (10) revision of items in the catalog identified during the field review as being faulty, and (11) preparation of the final catalog.

DEFINITION OF TERMS

The following terms have been defined as follows and are used consistently for the V-TECS project:

Blueprint. A scaled drawing of a part to be machined, including specifications containing material to be used, part(s) dimensions, shape, and information to determine the configuration of the finished part.

Catalog. A comprehensive collection of performance objectives, performance conditions (tools and equipment), performance guides and related data, organized by a job structure or career ladder within a domain of interest.

Domain. A cluster of related jobs.

D.O.T. Code. A nine digit number used to identify a specific job within a given domain.

Duty. One of the distinct major activities involved in the work performed, comprising related tasks.

Education Consortium. A group of state agencies, institutions, or other entities which have been legally constituted through letters of commitment, agreements, or by assignments of higher authorities to work together toward the solution of problems in education. A membership from autonomous agencies and institutions which cut across state boundaries as they attempt to solve problems or meet goals.

Job. The duties and tasks actually performed by a specific individual.

Job Specifications. Special requirements for a specified job or workpiece.

Manufacturer's Specifications/Standards. Requirements of manufacturers for care, adjustment or maintenance of a particular tool or machine.

Occupational Education. An organized sequence of learning experiences consisting of vocational theory, practice, and skill for students on a regular or systematic basis.

Occupational Inventory. A listing of tasks to be performed in a particular occupational area, grouped under duty classifications. Also called "task list".

Operator's Manual. Reference material furnished by manufacturers for operation of a particular machine.

Performance Guide. A series of steps, arranged in a sequence ordinarily followed, which when completed may result in the performance of a task. Also called "teaching steps".

Performance Objectives. A statement in precise, measurable terms of a particular behavior to be exhibited by a learner under specified conditions.

Task. A unit of work activity or operation that constitutes a logical and necessary step in the performance of a duty.

Task Analysis. A process of reviewing actual job content and context in business and industry for application to the development of performance objectives, and quality control within a program of vocational-technical education.

Workpiece. Material(s) supplied to machinists to be worked to blueprint specifications and/or job specifications.

PURPOSE OF THE CATALOG

This catalog was designed to provide performance objectives, tasks, standards, and performance guides associated with current occupational information relating to the job content of machinists, specifically Tool Grinder Operators, Production Lathe Operators, and Production Screw Machine Operators. Listed below are several of the intended uses of the catalog:

1. Objectives may be compared to existing programs for possible inclusion.
2. Measures may be used to determine entering student competencies, thus allowing for advanced placement, individualization of instruction, etc.
3. Measurement outcomes may be used to accept, improve, or reject an instructional procedure or system.
4. Performance guides may be used as a blueprint for designing curriculum which will support selected performance objectives.
5. Performance guides may be used as teaching points for the instructor, who may choose to develop supporting instructional objectives which are interim rather than terminal in nature.

DEVELOPMENT OF THE CATALOG

The methodology for the conduct of the project to develop performance objectives and performance guides for the job content of machine ~~trade~~ occupations is described in the following paragraphs.

Preliminary Research

A study to determine the state-of-the-art of instructional materials for machine shop was conducted early in the project. As many related materials as possible were identified and reviewed. During the course of the literature review, a preliminary task listing and tool and equipment listing were developed. In order to further develop and refine these listings, machinists were interviewed in regard to their job content. Interviewing was continued until the respective listings were fully developed. At this point, it was possible to produce an occupational inventory instrument with confidence that it was comprehensive.

Description of the Sample

The occupational inventory instrument, which included sections to collect background information, information on tools and equipment used, and information on tasks performed was administered by mail and by telephone interview to approximately 120 machine tool operators. They represented a sample which was randomly selected from the population of machinists in the State of Illinois. The rate of response was 42 percent.

Analysis of Data

Computer analysis of the data which resulted from the survey was performed by V-TECS, and the printouts were provided to the state project coordinator for interpretation and use in planning the catalog. Basic reports were provided and were useful in preparing the catalog items. Data relating to percentages of workers performing each task was used as a basis for selecting those tasks for which objectives were written.

The Writing Team

A team of specialists was used to review and refine the job-related tasks identified by the occupational survey for machine trade occupations. Performance objectives, tools, equipment, and performance guides were developed for the identified job-related tasks. The seven member team was selected on the basis of local and state recommendations, a demonstrated competency in machine shop work, and a willingness to serve. The team was composed of three job incumbents, one area vocational center machine shop instructor, one high school machine shop instructor, two apprenticeship instructors for machinists, and two people experienced in curriculum development and testing.

The Field Review

A field review copy of the Machine Tool Operations catalog was produced and reviewed by four individuals. The purpose of this field review was to provide further validation of the catalog as follows:

1. To provide careful review of all sections of the catalog.
2. To provide for editing as well as suggestions for rewording, etc.
3. To provide an evaluation of each performance objective, and, when included, performance guides for each job-related task (this was performed in terms of stated criteria with a response of either YES or NO as to whether or not criteria were met).
4. To provide an opportunity for further information input especially to any NO responses.

A representative of V-TECS developed a description of a sample of participants to serve on the field review team (three incumbents, one

vocational instructor, two curriculum specialists) for a total of six representing as many as possible of the geographic areas of Illinois.

The field review team was selected based on the criteria above as well as local and state recommendations, demonstrated technical competencies, and a willingness to serve. One hundred percent participation based on selection criteria was achieved.

ELEMENTS OF THE CATALOG

This catalog is comprised of performance objectives, tool and equipment lists, and performance guides which were prepared from job-related task statements from the occupational inventory.

Each performance objective contains the following elements: (1) the condition under which the student will perform the objective, (2) the performance required of the worker in the job environment, and (3) a job-relevant standard for measuring successful performance of the objective. The source of the standard for each objective is documented from one of the three sources outlined below:

1. The primary source of performance standards is job-based information provided in technical manuals, certification requirements, or other germane literature.
2. The secondary source of performance standards is the level of performance agreed upon by incumbent machinists and supervisors who served on the writing team or as consultants to the team.
3. The third source of performance standards is the subject matter specialists on the writing team. However, specialists are used only as resource when the first two sources are unavailable.

The source of the standard is identified after each performance objective. Listing of a reference in no way implies that this is the only source of an appropriate standard and certainly should not be construed as blanket endorsement of the organization or publication from which the standard was secured. There may be other valid sources in addition to those cited.

The tool and equipment list includes the required tools and equipment for completing the performance guides. Accessories included are the necessary tools and machine parts used with a basic machine.

The performance guides which accompany the tasks are procedural steps identified as subordinate to task performance. They may require slight modifications because of equipment differences, availability of tools, local practice, etc., and are suggested items.

PERFORMANCE OBJECTIVES, PERFORMANCE CONDITIONS,
AND PERFORMANCE GUIDES

DUTY: PERFORMING SUPERVISORY FUNCTIONS

PERFORMANCE OBJECTIVE NO. 1

TASK: Determine availability of supplies and materials

STANDARD: Materials and supplies must be ordered as needed, and the inventory records must be updated.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Inventory list
Information on reorder points
Inventory record
Requisition

PERFORMANCE GUIDE:

1. Determine supplies and materials needed for job.
2. Identify supplies and materials in stock.
3. Obtain needed supplies and materials.
 - a. order stock with requisition
 - b. record stock received
 - c. store stock
4. Maintain record of requisition.
5. Maintain work order files.

DUTY: PERFORMING SUPERVISORY FUNCTIONS

PERFORMANCE OBJECTIVE NO. 2

TASK: Check end product quality control standards

STANDARD: Inspect each unit on one-of-a-kind product, and a sample of units on mass-produced.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Blueprint specifications
Finished product (mass-produced and one-of-a-kind)
Precision measurement instruments

PERFORMANCE GUIDE:

1. Determine product standards from engineering or manufacturing specifications.
2. Determine which measuring instruments to use.
3. Inspect and measure each one-of-a-kind product.
4. Inspect and measure samples of mass-produced products based on quality control standards.
5. Reject or pass units according to quality control standards.

DUTY: PERFORMING SUPERVISORY FUNCTIONS

PERFORMANCE OBJECTIVE NO. 3**TASK: Supervise machine use and operation****STANDARD: During an eight hour work period optimum use of machinery must be maintained.****SOURCE FOR STANDARD: Writing team of incumbent workers****CONDITIONS FOR PERFORMANCE OF TASK:**

Machine shop

PERFORMANCE GUIDE:

1. Inspect work area conditions.
2. Prescribe machine maintenance.
 - a. determine cause of down time
 - b. initiate repairs
3. Insure proper machine operations with regard to safety and in accordance with manufacturer's specifications.

DUTY: PERFORMING SUPERVISORY FUNCTIONS

PERFORMANCE OBJECTIVE NO. 4

TASK: Supervise maintenance of shop safety equipment

STANDARD: Supervision of machinery setup, safe operations, and safety equipment maintenance must be in accordance with Occupational Safety and Health Act of 1970 standards.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Occupational Safety and Health Act (OSHA) standards
Safety equipment maintenance manuals

PERFORMANCE GUIDE:

1. Review OSHA standards for shop safety.
2. Observe equipment operations with respect to OSHA guidelines.
3. Observe equipment set up with respect to OSHA guidelines.
4. Maintain safety checks and maintenance schedule for shop safety equipment.

DUTY: PERFORMING SUPERVISORY FUNCTIONS

PERFORMANCE OBJECTIVE NO. 5

TASK: Inventory supplies and materials

STANDARD: Determine exact quantity of supplies and materials available and what is needed. All items must be counted and recorded on stock sheet.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Stock inventory list
Stock required list

PERFORMANCE GUIDE:

1. Obtain inventory records.
2. Count items in stock.
3. Record description and stock number of items.
4. Refer to reorder points to determine replacement needs.
5. Record maximum and minimum quantity and quantity to be ordered.

DUTY: PERFORMING MATHEMATICAL CALCULATIONS

PERFORMANCE OBJECTIVE NO. 6

TASK: Measure workpiece using inside caliper

STANDARD: Workpiece must be measured to an accuracy of plus or minus 1/64" of blueprint specifications.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Blueprint
Inside caliper
Steel rule
Workpiece

PERFORMANCE GUIDE:

1. Determine measurement specifications from blueprint.
2. Measure workpiece with steel rule and inside caliper.
 - a. apply one caliper leg to the very end of rule and measure with other leg
 - b. check for squareness of caliper against rule
3. Record measurement.

DUTY: PERFORMING MATHEMATICAL CALCULATIONS

PERFORMANCE OBJECTIVE NO. 7

TASK: Calculate amount of material to be removed to obtain correct limits for rework.

STANDARD: Must be within plus or minus .001 of blueprint specifications.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Blueprint
Calculator

PERFORMANCE GUIDE:

1. Determine dimensions of workpiece.
2. Record amount of material to be removed.

DUTY: PERFORMING MATHEMATICAL CALCULATIONS

PERFORMANCE OBJECTIVE NO. 8

TASK: Calculate conversion of revolutions per minute (RPM) to surface feet per minute (SFPM)

STANDARD: Answer must be rounded off to surface feet per minute (SFPM).

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Formula
Grinding wheel specifications
Machine operating RPM

PERFORMANCE GUIDE:

1. Calculate surface feet per minute (SFPM) using a reference formula, grinding wheel specifications, and machine specifications. NOTE: $SFPM = RPM \times \text{circumference of wheel in feet}$.
2. Round off answer to SF/M.

DUTY: PERFORMING MATHEMATICAL CALCULATIONS

PERFORMANCE OBJECTIVE NO. 9

TASK: Calculate dimensions of keyseats

STANDARD: A tolerance of $\pm .003$ must be obtained in calculations for correct fit.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Blueprint
Calculator
Key (woodruff)
Machinist's handbook

PERFORMANCE GUIDE:

1. Determine type of key stock.
 - a. flat
 - b. woodruff
2. Determine the depth of cut from engineer's handbook.

Formula for determining assembled key and shaft measurement of top of key to bottom of shaft:

$$J = S - (M + D) + C$$

where:

J = measurement over key and shaft
S = diameter of shaft
M = height of key above shaft
D = depth of cut
C = depth of key

Formula for milling keyseat:

$$M = 1/2 (S - \sqrt{S^2 - E^2})$$

where:

M = measurement
S = diameter of shaft
E = width of keyseat

DUTY: PERFORMING MATHEMATICAL CALCULATIONS

PERFORMANCE OBJECTIVE NO. 10

TASK: Calculate gear blank specifications for indexing

STANDARD: Gear blank specifications for indexing must be within $\pm .001$.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Calculator
Gear blank
Job specifications
Machinist's handbook

PERFORMANCE GUIDE:

1. Determine diametrical pitch, number of teeth, blank outside diameter, and whole depth of tooth.
2. Calculate indexing.
 - a. for plain indexing head, or,
 - b. for direct indexing

Plain indexing using 40:1 ratio:

Formula: $\frac{40}{N}$

where:

40 = constant

N = number of turns

DUTY: PERFORMING MATHEMATICAL CALCULATIONS

PERFORMANCE OBJECTIVE NO. 11

TASK: Calculate machine RPM for a given material size

STANDARD: RPM must be rounded off to the nearest whole number.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Calculator
Cutter specifications H.S.S.
Material removal rate - cubic inch (machinability)
Machinist's handbook reference
Workpiece cutting speed (SFPM)

PERFORMANCE GUIDE:

1. Calculate RPM using formula.
2. Determine feed by machinability rating.
3. Use machinery handbook.

Calculate RPM (speed) for mild steel using formula

$$\text{RPM} = \frac{\text{CS} \times 12}{3.14 \times D}$$

where:

CS = cutting speed (from machinery handbook)

12 = constant

3.14 = constant

D = diameter of stock or cutter

DUTY: PERFORMING MATHEMATICAL CALCULATIONS

PERFORMANCE OBJECTIVE NO. 12

TASK: Calculate stock utilization

STANDARD: Stock must meet blueprint material specifications.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Blueprint
Calculator
Stock inventory

PERFORMANCE GUIDE:

1. Study blueprint.
 - a. check finished stock size
 - b. check material required
2. Check scrap stock.
 - a. select and measure available stock
 - b. determine work holding device
 - c. determine machining operation
3. Complete list of materials.

DUTY: PERFORMING MATHEMATICAL CALCULATIONS

PERFORMANCE OBJECTIVE NO. 13

TASK: Calculate tolerances

STANDARD: Calculate tolerance and/or allowance for specific job to a bilateral tolerance of $\pm .001$ ".**SOURCE FOR STANDARD: Writing team of incumbent workers****CONDITIONS FOR PERFORMANCE OF TASK:**

Calculator
Job specifications
Machinery handbook

PERFORMANCE GUIDE:

1. Determine nominal basic size.
2. Apply bilateral dimensions to basic size.
3. Check maximum and minimum size of allowance between parts.
4. Calculate different types of fit.
 - a. transition
 - b. press (interference)
 - c. shrink
 - d. running
 1. class x, y, z

DUTY: PERFORMING MATHEMATICAL CALCULATIONS

PERFORMANCE OBJECTIVE NO. 14**TASK: Convert to metric measurement**

STANDARD: Nominal size measurement must match the conversion chart.**SOURCE FOR STANDARD: Writing team of incumbent workers****CONDITIONS FOR PERFORMANCE OF TASK:**

English linear measurement
Job specifications
Metric tables and/or charts

PERFORMANCE GUIDE:

1. Determine nominal size of measurement.
2. Check size of measurement to metric measurement.
3. Record results.

DUTY: PERFORMING MATHEMATICAL CALCULATIONS

PERFORMANCE OBJECTIVE NO. 15

TASK: Determine clearance, relief, and rake of cutting tools

STANDARD: Angular dimensions must be plus or minus 1/2 degree of print specifications

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Pre-ground cutting tool H.S.S.
Six-inch protractor with rule
Type of material to be machined
Tool gage

PERFORMANCE GUIDE:**1. Determine material to be machined****a. Ferrous material**

1. cast iron
2. mild steel
3. tool steel

b. Non-ferrous material

1. brass
2. aluminum
3. bronze

2. Select tool blank**a. High speed steel****b. Carbides**

DUTY: PERFORMING MATHEMATICAL CALCULATIONS

PERFORMANCE OBJECTIVE NO. 16

TASK: Determine material tensile strength

STANDARD: Tensile strength of material must meet specifications in machinery handbook.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Material of standard raw stock size
Table of strength data
Tensile testing machine

PERFORMANCE GUIDE:

1. Determine type of material.
2. Prepare test specimen.
3. Position material on tensile tester.
4. Record gage reading.

DUTY: PERFORMING MATHEMATICAL CALCULATIONS

PERFORMANCE OBJECTIVE NO. 17

TASK: Take micrometer readings to determine shaft diameter

STANDARD: Accuracy required for micrometer calipers is plus or minus .001". Accuracy required for vernier micrometer calipers is plus or minus .0001".

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Flat stock
Micrometer calipers
Round stock
Vernier micrometer calipers

PERFORMANCE GUIDE:

1. Clean stock.
2. "Zero in" micrometer.
3. Test piece part.
4. Record results.

DUTY: DESIGNING AND PLANNING MACHINE WORK

PERFORMANCE OBJECTIVE NO. 18

TASK: Sketch parts

STANDARD: All dimensions and views of sketching must be to job specifications.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Paper
Pencil
Specifications for part

PERFORMANCE GUIDE:

1. Sketch orthographic views.
2. Dimension-views.
3. Record bill of materials.
 - a. number of pieces
 - b. type of material
 - c. type of machine operations
 - d. finish operations

DUTY: DESIGNING AND PLANNING MACHINE WORK

PERFORMANCE OBJECTIVE NO.19

TASK: Perform layout for precision machine work using layout instruments

STANDARD: Lay out a workpiece according to blueprint specifications with location of positions within .001" and angles to an accuracy of 5 minutes.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Blueprint
Cleaner
Layout fluid
Layout tools
Precision measurement instruments
Workpiece

PERFORMANCE GUIDE:

1. Review blueprint.
2. Clean workpiece.
3. Coat workpiece with layout fluid.
4. Scribe reference line.
5. Scribe lines.
6. Check blueprint for accuracy.
7. Indicate required machining operations on job specifications.

DUTY: DESIGNING AND PLANNING MACHINE WORK

PERFORMANCE OBJECTIVE NO. 20

TASK: Locate holes from edge of workpiece using milling machine

STANDARD: Perform layout to within plus or minus .001 of blueprint specifications.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Blueprint
Collet or chuck
~~Combination drill~~
Edge finder
Milling machine
Workpiece
Vise

PERFORMANCE GUIDE:

1. Review blueprint.
2. Mount edge finder.
3. Mount workpiece.
4. Locate edge with edge finder.
5. Calculate dimensions.
6. Remove edge finder.
7. Insert combination drill in chuck.
8. Center drill hole.

DUTY : DESIGNING AND PLANNING MACHINE WORK

PERFORMANCE OBJECTIVE NO. 21

TASK: Inspect, remove and replace part(s) for repair or machine work

STANDARD: Worn part must be removed and replaced to machine specifications.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Appropriate tools
Job specifications
Maintenance manual
Machine parts
Precision measurement instruments

PERFORMANCE GUIDE:

1. Inspect each machine part to determine if it needs repair, replacement, or machine work.
2. Remove parts which are in need of repair, replacement, or work.
3. Route parts removed to the appropriate work station for work needed.
4. Inspect all returned parts.
5. Install parts on machine.
6. Align and adjust assembled unit.
7. Run machine with power off (prevent damage).
8. Run machine with power on.

DUTY: DESIGNING AND PLANNING MACHINE WORK

PERFORMANCE OBJECTIVE NO. 22

TASK: Test for hardness

STANDARD: Test must meet blueprint specifications.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Cast iron sample
Steel sample (soft-tempered, unhardened)
Test blocks
Comparative Hardness Scales
Rockwell Hardness Tester
Brinell Hardness Tester
Emery paper

PERFORMANCE GUIDE:

1. Remove all scale, rust, dirt, etc. from sample.
2. Place specimen on anvil.
3. Adjust hardness tester.
4. Apply minor load of 10 kg.
5. Set dial to zero on black figure scale.
6. Apply major load.
7. Remove major load.
8. Take reading while minor load is applied.
9. Derive hardness number from scale based on reading.

DUTY: PERFORMING METALWORK OPERATIONS

PERFORMANCE OBJECTIVE NO. 23**TASK: Clamp workpiece****STANDARD: Workpiece must be secured in holding device.****SOURCE FOR STANDARD: Writing team of incumbent workers****CONDITIONS FOR PERFORMANCE OF TASK:**

Machine accessories
Tools
Work holding device
Workpiece

PERFORMANCE GUIDE:

1. Identify types and sizes of holding devices.
2. Identify accessories for holding device.
3. Select proper work holding device and attachments for workpiece.
4. Secure work holding device to table.
5. Secure workpiece in holding device.
6. Check for level, squareness, or angle.
7. Inspect for safety of holding device.

DUTY: PERFORMING METALWORK OPERATIONS

PERFORMANCE OBJECTIVE NO. 24

TASK: Cut metal stock

STANDARD: Metal stock must be cut to within 1/64 of blueprint specifications.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Blueprint
Cutting tools
Measuring instruments
Metal stock
Work holding device

PERFORMANCE GUIDE:

1. Measure workpiece to determine size and amount to be cut.
2. Install metal stock in work holding device.
3. Select cutting tools.
4. Cut metal stock to blueprint specifications.
5. Check cut workpiece.

DUTY: PERFORMING METALWORK OPERATIONS

PERFORMANCE OBJECTIVE NO. 25**TASK:** Fabricate special cutting tools**STANDARD:** Fabricate cutting tool to within plus or minus .001 of blueprint specifications.**SOURCE FOR STANDARD:** Writing team of incumbent workers**CONDITIONS FOR PERFORMANCE OF TASK:**

Blueprint
Grinder
Precision measurement instruments
Tool steel

PERFORMANCE GUIDE:

1. Identify workpiece material.
2. Select tool steel.
3. Select cutter to perform machining operation.
4. Select grinder accessories.
5. Set up grinder.
6. Shape cutter to perform job specifications.
7. Measure cutter for accuracy.
8. Inspect cutter for sharpness.

DUTY: PERFORMING METALWORK OPERATIONS

PERFORMANCE OBJECTIVE NO. 26**TASK:** Heat treat metal**STANDARD:** Heat treat material must meet or exceed job specifications using procedures from the machinist's handbook.**SOURCE FOR STANDARD:** Writing team of incumbent workers**CONDITIONS FOR PERFORMANCE OF TASK:**

Heat treating equipment
Job specifications
Machinist's handbook
Tool steel

PERFORMANCE GUIDE:

1. Determine heat treatment procedures for workpiece.
 2. Determine temperature requirements from appropriate table.
 3. Select treating sequence from tool engineer's handbook.
 4. Select and set up heat treating equipment and accessories.
 5. Observe all safety rules for heat treating process.
 6. Heat treat workpiece.
 7. Test workpiece.
-

DUTY: PERFORMING METALWORK OPERATIONS

PERFORMANCE OBJECTIVE NO. 27**TASK: Operate cylindrical grinder**

STANDARD: Grind workpiece to within plus or minus .001 Total Indicator Reading (TIR) of blueprint specifications using machinist's handbook.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Alloy steel (annealed) workpiece
Carbon steel (hardened) workpiece
Blueprints for each workpiece
Cylindrical grinder
Machinist's handbook
Precision measurement devices
Work holding devices
Dial indicator

PERFORMANCE GUIDE:

1. Mount workpiece.
2. Determine workpiece finish.
3. Refer to machinist's handbook for basic process data.
4. Set grinder's traverse feed and workpiece RPM.
5. Adjust workpiece to grinding wheel.
6. Grind workpiece.
7. Measure workpiece for accuracy.

DUTY : PERFORMING METALWORK OPERATIONS

PERFORMANCE OBJECTIVE NO. 28

TASK: Operate hone to apply proper surface in a cylinder

STANDARD: Tolerance of the honed surface in cylinder must be between .0003" and .0005".

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Blueprint
Honing machine
Hones
Precision measurement instruments
Work holding devices
Workpiece with a bore diameter of 2 inches

PERFORMANCE GUIDE:

1. Attach and secure workpiece to work holding device.
2. Select hones.
3. Adjust hones to workpiece.
4. Flood hone and workpiece with coolant.
5. Hone workpiece to remove stock from bore diameter.
6. Measure workpiece and hone to size given in job specifications.

DUTY : PERFORMING METALWORK OPERATIONS

PERFORMANCE OBJECTIVE NO. 29

TASK: Perform bench cross filing

STANDARD: Workpiece must be filed to within .001 of blueprint specifications.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Bevel protractor
Blueprint
Files
File chart
File handles
File card
Measuring instruments
Steel square
Vise and false jaws
Workpiece

PERFORMANCE GUIDE:

1. Select appropriate file
 2. Check file handle
 3. Clean file.
 4. Mount workpiece.
 5. Test flatness and/or angle of work.
 6. Check for pinning.
 7. File to final tolerance.
 8. Check specifications.
-

DUTY: PERFORMING METALWORK OPERATIONS

PERFORMANCE OBJECTIVE NO. 30**TASK:** Polish metal**STANDARD:** Smooth finish surface must be polished within 64 microfinish.**SOURCE FOR STANDARD:** Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Abrasive
Blueprint
Finish scale
Grinder (buffing wheel)
Tripoli or rouge
Workpiece

PERFORMANCE GUIDE:

1. Determine method of polishing (machine and/or hand).
 2. Select abrasive.
 3. Examine surface of workpiece.
 4. Smooth metal surface.
 5. Clean off abrasive.
-

DUTY: PERFORMING METALWORK OPERATIONS

PERFORMANCE OBJECTIVE NO. 31

TASK: Measure depth of a blind hole

STANDARD: Counterbore must be to a tolerance of plus or minus 1/64" using rule depth gage and plus or minus .015" using the micrometer depth gage or to specifications.

SOURCE FOR STANDARD: Writing team of incumbent workers

~~CONDITIONS FOR PERFORMANCE OF TASK:~~

Micrometer depth gage
Rule depth gage
Workpiece, drilled and counterbored

PERFORMANCE GUIDE:

Rule Depth Gage

1. Clean reference surface.
2. Slide rule as far as it will go into the hole without disturbing contact of gage head and work.
3. Tighten clamp nut.
4. Remove from hole and read depth dimension on rule at junction with gage head.

Micrometer Depth Gage

1. Insert appropriate measuring rod.
2. Project the measuring rod through finish base for a reference surface at right angles to the hole.
3. Turn the thimble on the sleeve for accurate measurement.
4. Read depth dimension on micrometer sleeve.

DUTY: PERFORMING METALWORK OPERATIONS

PERFORMANCE OBJECTIVE NO. 32

TASK: Measure concentricity with dial test indicator

STANDARD: Dial indicator must be accurate to within plus or minus .0001" of blueprint specifications.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Dial test indicator
Work holding device
Workpiece

PERFORMANCE GUIDE:

1. Mount dial indicator to tool holding device.
2. Align workpiece with dial indicator.
3. Adjust workpiece until desired tolerance is reached.

DUTY: PERFORMING METALWORK OPERATIONS

PERFORMANCE OBJECTIVE NO. 33

TASK: Measure with height gages using gage blocks

STANDARD: Layout measurements must be within a tolerance of plus or minus .001" or to blueprint specifications.

SOURCE FOR STANDARD: ~~Writing team of incumbent workers~~

CONDITIONS FOR PERFORMANCE OF TASK:

Blueprint
Cleaner
Gage blocks
Height gage
Precision measurement instruments
Scribe points
Workpiece
Surface plate

PERFORMANCE GUIDE:

1. Clean surface plate.
 2. Place workpiece and height gage on surface plate.
 3. Select attachments for height gage.
 4. Wring gage blocks together to specified dimension.
 5. Set height gage to gage blocks.
 6. Transfer measurement to workpiece.
-

DUTY: PERFORMING METALWORK OPERATIONS

PERFORMANCE OBJECTIVE NO. 34

TASK: Measure with sine bar

STANDARD: Workpiece measurement must be within plus or minus 5 minutes or to blueprint specifications.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Gage blocks
Job specifications
Machinist's handbook
Sine bar (5 inch)
Surface plate
Precision measurement instruments
Workpiece
Height gage
Dial indicator

PERFORMANCE GUIDE:

1. Clean surface plate, gage blocks and sine bar, if required.
2. Determine angle requirement.
3. Select gage blocks and wring together.
4. Place sine bar on surface plate with gage blocks under sine bar roll.
5. Place workpiece on sine bar and adjust setup to determine workpiece angle.
6. Check angle with dial indicator by moving both indicator and height gage on entire surface of workpiece.

DUTY: PERFORMING BENCH WORK

PERFORMANCE OBJECTIVE NO. 35

TASK: Cut materials with hand hacksaws

STANDARD: Sawed workpiece must be within 1/64" of job specifications.

SOURCE FOR STANDARD: ~~Writing team of incumbent workers~~

CONDITIONS FOR PERFORMANCE OF TASK:

Aluminum pipe
Hacksaw frame
Hacksaw blades
Job specifications
Soft jaws
Work holding device (vise)

PERFORMANCE GUIDE:

1. Select the correct blade.
 2. Mount blade.
 3. Secure workpiece.
 4. Saw workpiece.
 - a. saw backwards slowly and with light pressure to make saw kerf.
 - b. apply forward strokes lightly until saw blade has seated in kerf.
 - c. work approximately 70 strokes per minute until material is cut.
-

DUTY: PERFORMING BENCH WORK

PERFORMANCE OBJECTIVE NO. 36

TASK: Cut threads with dies

STANDARD: Cut threads must meet a class 2A fit.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Blueprint
Cutting oils
Dies
Diestock
File
Rule
Vise
Workpiece

PERFORMANCE GUIDE:

1. Select die.
2. Secure workpiece in vise.
3. Mount die in diestock.
4. Bevel the end of the workpiece.
5. Square diestock to workpiece.
6. Cut threads and lubricate during threading operation.
7. Check threaded workpiece to specifications.
8. Finish bevel workpiece.

DUTY: PERFORMING BENCH WORK

PERFORMANCE OBJECTIVE NO. 37

TASK: Hand sharpen cutting tools with abrasive stones

STANDARD: Edges must be honed with all burrs removed

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Cutting tools
Job specifications
Lubricant
Oil stones (hones)
Slip stones

PERFORMANCE GUIDE:

1. Select cutter sharpener (stone)
2. Sharpen to specifications (lubricate during sharpening).
3. Inspect cutter.
4. Clean sharpener.

DUTY: PERFORMING BENCH WORK

PERFORMANCE OBJECTIVE NO. 38

TASK: Ream holes with hand reamers

STANDARD: Hole must be reamed to a tolerance of .0001" to .0005" of specifications.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Blueprint
Drill press
Spring loaded center
Lubricant
Tap wrench
Work holding device
Workpiece

PERFORMANCE GUIDE:

Hand Reaming - Bench Work

1. Secure workpiece to work holding device
2. Select reamer.
3. Mount reamer in tap wrench.
4. Lubricate and ream to specifications.

Hand Reaming with Drill Press

1. Complete steps 1-3 above.
2. Mount spring loaded center in drill press spindle.
3. Align center to tap wrench.
4. Lubricate and hand ream to specifications.

DUTY: PERFORMING BENCH WORK

PERFORMANCE OBJECTIVE NO. 39

TASK: Remove and replace helical coil wire screw thread insert (STI)

STANDARD: Helical coil must be firmly secured in the hole.

SOURCE FOR STANDARD: Writing team of incumbent workers

~~CONDITIONS FOR PERFORMANCE OF TASK:~~

Cleaner
Helical coils
Pliers
Tables of taps for (STI)
Taps
Tap wrench
Work holding device
Workpiece

PERFORMANCE GUIDE:

1. Secure workpiece in work holding device.
 2. Remove worn or damaged helical coil (STI).
 3. Select proper tap.
 4. Clean or retap threads.
 5. Select proper helical coil (STI).
 6. Insert helical coil (STI) and check to specifications.
-

DUTY: PERFORMING BENCH WORK

PERFORMANCE OBJECTIVE NO. 40

TASK: Remove damaged screws and other non-hardened threaded hardware.

STANDARD: Part must be removed without damaging threads in hole.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Center punch
Chuck key
Drill motor
Screw extractor
Taps
Tap wrench
Work holding device
Workpiece
Drills

PERFORMANCE GUIDE:

1. Secure workpiece in work holding device.
2. Select drill, center punch, and drill hole in damaged part.
3. Place screw extractor in hole.
4. Remove damaged part.
5. ~~Inspect threads in hole.~~

DUTY: PERFORMING BENCH WORK

PERFORMANCE OBJECTIVE NO. 41

TASK: Shape metal

STANDARD: Workpiece must be to a tolerance of plus or minus .020 flat.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Air grinder
 Air supply
 Blueprint
 Cutter bits
 Chuck wrench
 Hand chisels
 Hammers
 Measurement devices
 Punches
 Work holding device
 Workpiece

Oxygen and acetylene torch
 outfit

PERFORMANCE GUIDE:

High Speed Air Grinder

1. Secure cutting bit in chuck.
2. Check air supply.
3. Connect grinder to air supply.
4. Secure workpiece in work holding device.
5. Shape workpiece.

Shape and Work to Specifications

1. Use portable hand drill with proper tool attachments.
2. Select and use sharpened hand chisels, punches, and hammers.
3. Shape and work to job specifications.
4. Measure for accuracy.

DUTY: OPERATING DRILL PRESSES

PERFORMANCE OBJECTIVE NO. 42

TASK: Center punch hole

STANDARD: Hole must be punched to within plus or minus 1/64" of blueprint specifications.

SOURCE FOR STANDARD: Writing team of incumbent workers.

CONDITIONS FOR PERFORMANCE OF TASK:

Scribe
Ballpeen hammer
Blueprint
Center punch
Center head and scale
Dividers
Prickpunch
Surface plate
Workpiece
Layout dye
Vise

PERFORMANCE GUIDE:

1. Secure workpiece in vise.
2. Apply layout due to surface.
3. Scribe three lines using center head.
4. Prick punch on center lines very lightly and inspect. If punch mark is off from center, slant prick punch and repunch.
5. Center the center punch on top of prick punch mark and hit with balpeen hammer.
6. Inspect again.

DUTY: OPERATING DRILL PRESSES

PERFORMANCE OBJECTIVE NO. 43**TASK:** Counterbore holes.**STANDARD:** Bore must be within a tolerance of plus or minus $1/64$ " of blueprint specifications.**SOURCE FOR STANDARD:** Writing team of incumbent workers**CONDITIONS FOR PERFORMANCE OF TASK:**

Blueprint
Cap screws
Center punch
Counterbores
Cutting oil
Drills
Drillpress
Layout dye
Precision measurement instruments
Scribe
Work holding device
Workpiece

PERFORMANCE GUIDE:

1. Layout and scribe center lines.
2. Center punch hole location.
3. Secure workpiece in work holding device.
4. Select drill and drill hole to be counterbored.
5. Select counterbore and secure in drillpress.
6. Set drillpress stops and speed.
7. Apply cutting oil and counterbore to specifications.
8. Check accuracy of counterbore.

DUTY: OPERATING DRILL PRESSES

PERFORMANCE OBJECTIVE NO. 44**TASK:** Countersink hole**STANDARD:** Hole must be countersink to within a tolerance of plus or minus .010" of blueprint specifications.**SOURCE FOR STANDARD:** Writing team of incumbent workers**CONDITIONS FOR PERFORMANCE OF TASK:**

Blueprint
Centerpunch
Cutting oil
Countersinks
Drills
Drillpress
Flathead screw
Layout dye
Precision measurement instruments
Scribe
Work holding device
Workpiece

PERFORMANCE GUIDE:

1. Layout and scribe center lines.
2. Center punch hole location.
3. Secure workpiece in work holding device.
4. Select drill and drill hole to be countersunk.
5. Select countersink and secure in drillpress.
6. Set countersink central with hole or align countersink to hole.
7. Set drillpress stops and speed.
8. Apply cutting oil and countersink to specifications.
9. Check accuracy of countersink. (use flathead screws)

DUTY: OPERATING DRILL PRESSES

PERFORMANCE OBJECTIVE NO. 45**TASK: Drill hole**

STANDARD: Hole must be drilled to within
 $+ 0.005" + 0.005"$ (nominal drill diameter in inches)
 $- 0.001" - 0.003"$ (nominal drill diameter in inches)

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Blueprint
Combination drill
Deburring tool
Drills
Drillpress
Lubricant
Table of drills
Work holding device
Workpiece

PERFORMANCE GUIDE:

1. Identify workpiece material.
2. Select holding device and accessories.
3. Secure work in work holding device and check setup for rigidity.
4. Determine hole size.
5. Align workpiece and center drill.
6. Select and mount drill.
7. Drill to dimensions.
8. Deburr hole.

DUTY: OPERATING DRILL PRESSES

PERFORMANCE OBJECTIVE NO: 46

TASK: Mount and secure work

STANDARD: Work must be secure to insure adequate finish of part.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Job specifications
Mallet
Work holding device
Workpiece

PERFORMANCE GUIDE:

1. Select and mount proper work holding device.
2. Select appropriate clamps.
3. Secure work in work holding device.
4. Tap material to insure seating.

DUTY: OPERATING DRILL PRESSES

PERFORMANCE OBJECTIVE NO. 47**TASK:** Sharpen drill**STANDARD:** Drill must be sharpened to reduce drill breakage, and drill accurate to within plus or minus .005".**SOURCE FOR STANDARD:** Writing team of incumbent workers**CONDITIONS FOR PERFORMANCE OF TASK:**

Drills
Drill grinding fixture
Drill point gage
Drill references
Grinder
Wheel dresser

PERFORMANCE GUIDE:

1. Follow manufacturer's manual to operate drill grinding fixture.
2. Check all guards for alignment.
3. Dress and true grinding wheel.
4. Grind lip clearance, length, and angle to specifications.
5. Check for sharpness.

DUTY: OPERATING DRILL PRESSES

PERFORMANCE OBJECTIVE NO. 48

TASK: Sharpen drill bit free hand

STANDARD: Drill bit must be free of surface lands, have correct lip clearance, and correct drill angle for drilling standard material.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Drills
Drill point gage
Grinder
Wheel dresser
Specifications in reference handbook

PERFORMANCE GUIDE:

1. Observe safety practices.
2. Check all guards for alignment.
3. Inspect drill.
4. Dress and true grinding wheel.
5. Grind lip clearance, length, and angle to specifications.
6. Check for sharpness, correct lip and drill point angle.

DUTY: OPERATING DRILL PRESSES

PERFORMANCE OBJECTIVE NO. 49

TASK: Set drill press for proper feed rate and RPM of spindle

STANDARD: RPM and feed rate must be set for 1/2 drill bit.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Blueprint
Manufacturer's operation manual
Machinist's handbook Table of Cutting Speeds

PERFORMANCE GUIDE:

1. Determine speed and feed. ($\text{RPM} = \text{cs} \times 4/D$).
2. Adjust spindle speed.
3. Set drill press for proper feed, if applicable.
4. Apply formula for determining cutting speeds.

DUTY: OPERATING DRILL PRESSES

PERFORMANCE OBJECTIVE NO. 50**TASK: Spotface workpiece****STANDARD:** Spotface workpiece must be free from chatter and tool marks.**SOURCE FOR STANDARD:** Writing team of incumbent workers**CONDITIONS FOR PERFORMANCE OF TASK:**

Blueprint
Lubricant
Spotfacing tools
Workpiece (mild steel)
Drill press

PERFORMANCE GUIDE:**Spotface Flat Surface**

1. Identify workpiece material.
2. Select work holding device and accessories.
3. Secure work holding device and check setup for rigidity.
4. Align workpiece.
5. Select speed.
6. Spotface workpiece
 - a. lubricate
 - b. drill to dimensions

Spotface Hole

1. Use steps 1-5 above.
2. Align pilot with hole.
3. Spotface workpiece.
 - a. lubricate
 - b. drill to dimensions

DUTY: OPERATING DRILL PRESSES

PERFORMANCE OBJECTIVE NO. 51**TASK:** Hand tap hole**STANDARD:** Hole must be tapped for a class 2B thread according to blueprint specifications.**SOURCE FOR STANDARD:** Writing team of incumbent workers**CONDITIONS FOR PERFORMANCE OF TASK:**

Blueprint	Lubricant
Combination drill and countersink	Machinist's handbook
Measurement instruments	Tap drills
Center (straight shank)	Taps
Drill chuck and key	Tap Wrench
Drillpress	
Drillpress vise	

PERFORMANCE GUIDE:

1. Select tap drill and tap as specified on blueprint.
2. Mount and secure workpiece to drill table vise.
3. Mount, secure, and align combination drill and countersink to workpiece.
4. Select and set drillpress speed.
5. Center drill workpiece.
6. Tap drill workpiece.
7. Mount tap in tap wrench.
8. Mount center in drill chuck and align to tap wrench center.
9. Hand tap hole to specifications using lubricant.

DUTY: OPERATING DRILL PRESSES

PERFORMANCE OBJECTIVE NO. 52

TASK: Adjust drill press automatic feed.

STANDARD: Automatic speed must drill a 1.000 hole to a tolerance of plus or minus .010.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Blueprint
Drillpress
Machinist's handbook
Workpiece

PERFORMANCE GUIDE:

1. Determine drill press operation.
2. Secure workpiece in work holding device.
3. Secure tools and attachments.
4. Align tool to workpiece.
5. Determine and set feed.
6. Engage powerfeed and perform drill press operation.

DUTY: OPERATING GRINDING MACHINES

PERFORMANCE OBJECTIVE NO. 53

TASK: Attach and align materials for grinding

STANDARD: Material must be ground to a tolerance of $\frac{+.001"}{-.000"}$.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Dial indicator
Diamond point dressing tool
Micrometer caliper
Work holding device

PERFORMANCE GUIDE:

General Grinding (surface)

1. Select grinding wheel.
2. Test wheel for cracks (replace if cracked).
3. Mount, true, and dress wheel.
4. Secure work holding device and workpiece.
5. Position and adjust workpiece to wheel.

Cylindrical Grinding and Polishing

1. Repeat steps 1-3 in general grinding.
2. Secure work between centers.
3. Center workpiece.

DUTY: OPERATING GRINDING MACHINES

PERFORMANCE OBJECTIVE NO. 54

TASK: Balance grinding wheel

STANDARD: Balance must be held to .0005 wheel run out.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Balance stand
Grinding wheel
Weights
Wheel mount

PERFORMANCE GUIDE:

1. Mount hub or wheel mount on arbor.
2. Ring test wheel for cracks (replace if cracked).
3. Mount on balance stand.
4. Adjust weights to balance hub.
5. Remount hub or wheel mount on grinder.
6. Mount wheel to hub according to manufacturer's specifications.

DUTY: OPERATING GRINDING MACHINES

PERFORMANCE OBJECTIVE NO. 55

TASK: Cut off or part materials with grinding machines

STANDARD: Cut off material must not be work hardened as determined by blueprint specifications.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Blueprint
Cut off machine
Reinforced abrasive cut-off wheel
Workpiece

PERFORMANCE GUIDE:

1. Mount and secure reinforced abrasive cut-off wheel.
2. Check wheel and wheel guards (replace defective wheel).
3. Secure workpiece in work holding device.
4. Cut workpiece to blueprint specifications.

DUTY: OPERATING GRINDING MACHINES

PERFORMANCE OBJECTIVE NO. 56

TASK: Dress and true grinding wheels on surface grinders

STANDARD: Grinding wheels dressed for rough grinding must not exceed .002-.003 feed/revolution.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Diamond point dresser
Fixed tool post
Grinder
Grinding wheel

PERFORMANCE GUIDE:

1. Ring test wheel for cracks (replace if cracked).
2. Select diamond point dresser.
3. Place truing tool in attachment.
4. Secure tool to surface chuck.
5. Insure guards and safety equipment are appropriate.
6. Bring wheel into contact with diamond dresser.
7. Advance wheel head .001 on the dresser and cross feed table to opposite side of wheel.
8. Advance wheel head again .001 toward dresser and feed out to original beginning.
9. Repeat steps 7 and 8 until wheel is clean and dressed.

DUTY: OPERATING GRINDING MACHINES

PERFORMANCE OBJECTIVE NO. 57

TASK: Inspect grinding wheels

STANDARD: Grinding wheels must be free of cracks and wheel defects.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Grinding wheel
Non-metallic implement

PERFORMANCE GUIDE:

1. Lift wheel.
2. Inspect visually for cracks or chips.
3. Hold or suspend wheel on its ferrule and ring test for cracks.
4. If wheel is mounted:
 - a. ring test for cracks
 - b. adjust and secure all guards
 - c. if the wheel "ring tests" to indicate no cracks, run the wheel at full speed for at least one minute.

DUTY: OPERATING GRINDING MACHINES

PERFORMANCE OBJECTIVE NO. 58

TASK: Measure, inspect, and rework workpiece

STANDARD: Workpiece must be reworked to a tolerance of plus or minus .0001" of blueprint specifications.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Blueprint
Grinder
Heat-treated workpiece
Precision measurement instruments

PERFORMANCE GUIDE:

1. Inspect workpiece, checking for flaws and burrs.
2. Determine rework dimensions.
3. Check finish dimensions.

DUTY: OPERATING GRINDING MACHINES

PERFORMANCE OBJECTIVE NO. 59

TASK: Polish with grinding machine

STANDARD: Workpiece must be free of tool scratches.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Grinder and accessories
Job specifications
Polishing wheel
Workpiece
Tripoli or jewelry's rouge in wax form

PERFORMANCE GUIDE:

1. Determine workpiece material.
2. Select and mount polishing wheel.
3. Secure workpiece.
4. Polish to job specifications, applying polishing compounds as needed.

DUTY: OPERATING GRINDING MACHINES

PERFORMANCE OBJECTIVE NO. 60

TASK: Set speeds and feeds of power feed grinders

STANDARD: Speeds and feeds must be set according to machinability ratings of material.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Blueprint
Grinder operation manual
Workpiece
Cylindrical grinder

PERFORMANCE GUIDE:

1. Identify workpiece material.
2. Determine grinding requirements (amount of metal to be removed; desired finish and accuracy; grinder power and rigidity).
3. Compute and determine desired peripheral speed.
4. Determine and set grinder speed.
5. Determine and set grinder feed.

DUTY: OPERATING GRINDING MACHINES

PERFORMANCE OBJECTIVE NO. 61

TASK: Set up and perform surface grinding operations

STANDARD: Workpiece must be ground to a flat within
63-32 micro finish.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Blueprint
Grinder and accessories
Operation manual
Precision measurement instruments (proflometer)
Work holding device
Workpiece

PERFORMANCE GUIDE:

1. Select and secure work holding device.
2. Select, check and mount grinding wheel.
3. True and dress wheel.
4. Set RPM of workpiece and feed rate.
5. Select coolant.
6. Secure and align workpiece.
7. Grind to specifications.

DUTY: OPERATING GRINDING MACHINES

PERFORMANCE OBJECTIVE NO. 62

TASK: Set up grinder to sharpen plain milling cutters

STANDARD: Remove .006" to .010" from flat face of cutter and maintain a clearance angle of 4 degrees to 7 degrees, or to accuracy of table specifications.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Diamond point dresser
Machinist's handbook
Mandrel
Plain milling cutter
Reference tables

Dial indicator
Plain #1 wheel - aluminium oxide
Swivel or spring type toothrest bracket
Universal grinding machine
Center gage

PERFORMANCE GUIDE:

1. Set grinding machine for straight cylindrical grinding using indicator.
 - a. mount cutter on mandrel.
 - b. check grinding wheel for cracks
 - c. dress and true grinding wheel
 - d. mount cutter and mandrel between centers of machine stocks
 - e. align center of cutter to center of grinding wheel (center gage).
 - f. Raise the wheel head above the center of the cutter.
 $W = (\sin \text{ of clearance } L) \times \text{radius of grinding wheel for } 4^\circ \text{ or } 7^\circ \text{ desired}$
 - g. secure and align toothrest bracket to table
 - h. place toothrest under tooth to be ground
2. Observe and follow all safety practices.
3. Take light cut on first tooth to be sharpened.
4. Rotate cutter upward to sharpen next tooth.
5. Repeat steps 3 and 4 until all teeth have been ground.
6. Inspect all cutter teeth for sharpness.
7. Take a second cut, if needed, to reach desired sharpness.
8. Repeat steps 3 to 7 until desired degree of sharpness is obtained.

DUTY: OPERATING GRINDING MACHINES

PERFORMANCE OBJECTIVE NO. 63

TASK: Set up, grind, and sharpen preshaped lathe tools

STANDARD: Tool contour must meet table requirements with angular dimensions with plus or minus 1/2 degree.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Angular vise
Bevel protractor
Blueprint
Clearance and cutting angle gage
Diamond point dresser
Preshaped lathe tool
Reference handbook
Surface grinder

PERFORMANCE GUIDE:

1. Set up surface grinder.
 - a. check wheel for cracks
 - b. secure all guards
 - c. adjust and secure tool rest
 - d. dress and true wheel
2. Determine lathe tool angles.
 - a. identify workpiece material
 - b. identify type of cut
 - c. determine required rake and clearance angles from table
3. Grind lathe tool to desired contour.
 - a. adjust and secure tool rest (vise).
 - b. locate cutting edge and grind
 - c. grind rake and clearance angles
 - d. measure angles and inspect for sharpness
 - e. repeat steps b to d until desired contour of tool is obtained

DUTY: OPERATING GRINDING MACHINES

PERFORMANCE OBJECTIVE NO. 64**TASK: Shape chisels****STANDARD: Shape chisel to an included angle of from 60 to 70 degrees.****SOURCE FOR STANDARD: Writing team of incumbent workers****CONDITIONS FOR PERFORMANCE OF TASK:**

Bevel protractor
Chisel
Machinist's square
Tool grinder
Wheel dresser

PERFORMANCE GUIDE:

1. Adjust and secure tool rest
2. Dress and true wheel
3. Remove mushroom head from chisel
4. Grind to desired angle
5. Measure angle
6. Regrind, if necessary
7. Grind cutting edge concave

DUTY: OPERATING GRINDING MACHINES

PERFORMANCE OBJECTIVE NO. 65

TASK: Set up grinder to run workpiece between centers

STANDARD: Workpiece must not have any taper and a tolerance of plus or minus .0005 is permitted.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Center drilled workpiece
Cleaning shop towels
Coolant
Cylindrical grinder
Diamond point dresser
Grinding wheels
Machinist's handbook

Steady rest
Tail bar
Splash trays
Dial indicator
Drive plate
Lathe dog
Centers

PERFORMANCE GUIDE:

1. Clean table.
2. Secure drive plate on spindle nose with live center.
3. Secure dead center in footstock.
4. Align centers.
5. Select and mount grinding wheel.
 - a. check for cracks
 - b. true and dress wheel
6. Secure lathe dog to workpiece and mount between centers.
7. Mount, align, and secure steady rest. (if needed)
8. Fill machine storage tank with proper coolant.
9. Select and set wheel speed, traverse speed, depth of cut, and work speed.

DUTY: OPERATING GRINDING MACHINES

PERFORMANCE OBJECTIVE NO. 66

TASK: Set up surface grinder to run on magnetic chuck

STANDARD: Operations must produce close tolerances of 63 micro finish.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Cleaner
Coolants
Diamond point dresser
Grease
Grinder
Grinding wheel
Hones

Machinery handbook
Magna-vise clamps
Magnetic chuck
Parallels
Shop towels
Squeegee
V-blocks

PERFORMANCE GUIDE:

1. Fill coolant tank.
2. Place chuck in grinder table pads.
3. Hone and clean surface chuck.
4. Select and mount wheel.
 - a. check wheel for cracks
 - b. dress and true wheel
5. Clean chuck with shop towel.
6. Mount workpiece on chuck using:
 - a. parallels
 - b. V-blocks
 - c. clamps
 - d. perma-clamps
7. Turn on magnetic switch to chuck.

DUTY: OPERATING LATHES

PERFORMANCE OBJECTIVE NO. 67

TASK: Align lathe centers using approximate method

STANDARD: Centers must be in the same horizontal and vertical plane.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Lathe wrenches
Spindle adaptor
One dead center
One live center

PERFORMANCE GUIDE:

1. Mount centers in headstock and tailstock.
2. Check center alignment.
3. Align dead center to live center by moving tailstock perpendicularly to bed of lathe.
4. Adjust and tighten screws.

DUTY: OPERATING LATHES

PERFORMANCE OBJECTIVE NO. 68

TASK: Align lathe centers using accurate measurement

STANDARD: Centers must be to a tolerance within plus or minus .0005".

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Dial indicator
Drill rod test bar
Lathe wrenches
Spindle adaptor
One dead center
One live center (ballbearing center)

PERFORMANCE GUIDE:

1. Mount clean centers in headstock and tailstock.
2. Secure drill rod test bar between centers.
3. Mount dial indicator on lathe carriage.
4. Check center alignment.
5. Move lathe carriage from tailstock to head and observe reading.
6. Make necessary adjustments.

DUTY: OPERATING LATHES**PERFORMANCE OBJECTIVE NO. 69****TASK:** Bore holes with lathe**STANDARD:** Bore hole to blueprint specifications to a depth of plus or minus 1/64" and a diameter of plus or minus .003" tolerance.**SOURCE FOR STANDARD:** Writing team of incumbent workers**CONDITIONS FOR PERFORMANCE OF TASK:**

Blueprint
 Boring bar
 Combination drill and countersink
 Tool holders
 3 jaw chuck
 Micrometer calipers

Steel rule
 Workpiece
 Drills
 Inside calipers
 Drill chuck and key
 Tool bit (face)
 Depth gage

PERFORMANCE GUIDE:

1. Chuck workpiece in lathe.
2. Select and set lathe speed (RPM).
3. Mount tool holder and bit.
4. Face and square workpiece.
5. Place chuck in tailstock and center drill workpiece.
6. Remove center drill and drill hole using tailstock depth measurements.
7. Measure hole with depth gage micrometer.
8. Remove drill chuck and right hand tool holder.
9. Place boring bar and tool holder on compound rest. Center tool to center of lathe.
10. Set speed (RPM).
11. Bore hole to diameter.

DUTY: OPERATING LATHES

PERFORMANCE OBJECTIVE NO. 70

TASK: Counterbore holes with lathe

STANDARD: Hole must be bored to within a plus or minus 1/64" of blueprint specifications.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Blueprint
Boring bar
Cutting tool holder
Faced stock with drilled hole
Inside precision measurement instruments
Lathe attachments - micrometer carriage stops
3-jaw chuck

PERFORMANCE GUIDE:

1. Chuck stock in lathe.
2. Mount boring bar in holder.
3. Adjust boring bar and carriage stops.
4. Set RPM of machine.
5. Make rough cuts.
6. Check rough dimensions.
7. Adjust micrometer collar on lathe for finish cut.

DUTY: OPERATING LATHES

PERFORMANCE OBJECTIVE NO. 71

TASK: Countersink holes using lathe

STANDARD: Holes must be countersunk to within a tolerance of plus or minus .010" of blueprint specifications.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK: -

Blueprint
Combination drill and countersink
Countersink
Lathe
Lathe tool holders
Lathe cutter bit
Workpiece
Drills
Drill chuck and key
3-jaw chuck and key

PERFORMANCE GUIDE:

Using Countersink Cutter

1. Chuck workpiece in lathe.
2. Select and set lathe speed.
3. Face and square workpiece.
4. Center drill workpiece.
5. Drill workpiece.
6. Mount countersink in tail stock chuck.
7. Countersink to plus or minus .010".

Using Lathe Cutter Bit

1. Follow steps 1 to 5 under using countersink center.
2. Mount tool holder and cutter bit on compound rest.
3. Set compound rest angle.
4. Countersink to blueprint specifications.

DUTY: OPERATING LATHES

PERFORMANCE OBJECTIVE NO. 72

TASK: Using taper attachment, cut long external tapered surfaces

STANDARD: Taper surface must be cut to fit number 3 Morse taper.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Blueprint	Jacobs chuck and key
Combination drill	Tool holder
Countersink	Lathe bit
Cutting tool	Lathe dog
Lathe with taper attachment	Precision measurement instruments
Workpiece	
Chuck lathe and key	

PERFORMANCE GUIDE:

1. Chuck workpiece on lathe.
2. Select and set speed.
3. Mount 3-jaw chuck.
4. Mount tool holder and tool bit on center line of lathe.
5. Face and center drill workpiece.
6. Secure workpiece between centers.
7. Set taper attachment.
8. Make roughing cut.
9. Measure workpiece and make adjustments.
10. Finish cut to specifications.

DUTY: OPERATING LATHES

PERFORMANCE OBJECTIVE NO. 73

TASK: Cut short external tapered surfaces using compound rest

STANDARD: Taper must be cut to 30° included angle.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Blueprint
Cutting tool
Lathe
Precision measurement instruments
Workpiece
Tool holder
Lathe chuck and key (3-jaw)
Lathe dog

PERFORMANCE GUIDE:

1. Chuck workpiece on lathe.
2. Select and set speed.
3. Set compound rest to blueprint specifications.
4. Set up tool for cutting on center of machine.
5. Make roughing cut.
6. Measure workpiece and make adjustments.
7. Finish cut to blueprint specifications.

DUTY: OPERATING LATHES

PERFORMANCE OBJECTIVE NO. 74

TASK: Cut internal unified standard threads with lathe

STANDARD: Threads must be cut to meet a class 2B fit.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Blueprint	Internal thread specifications
Boring bar	Single point threading tool
Combination drill	Thread center gage
Precision measurement instruments	Countersink
Cutting tool	Workpiece
Drills	Drill chuck and key (Jacobs)
Tool holder	3-jaw chuck and key

PERFORMANCE GUIDE:

1. Chuck workpiece in lathe.
2. Select and set speed.
3. Face and center drill workpiece.
4. Step drill workpiece.
5. Mount boring tool holder and bore hole to specifications.
6. Turn compound rest 30° toward the head stock, with threading tool on center. Square tool with workpiece.
7. Set lathe gear box to desired pitch of thread.
8. Select speed (RPM) (slow).
9. Engage half nut lever (for odd or even number of pitches use specifications) on chasing dial.
10. When threading tool has reached its end open half nut.
11. Back off threading tool by cross feed (to clear thread) and return carriage by hand wheel to starting position.
12. Feed compound rest by no more than .005-.015 depth of cut (rigidity of machine variable).
13. Repeat steps 9, 10, and 11 until thread has reached its correct pitch diameter.
14. Use test piece (external) for fit.

DUTY: OPERATING LATHES

PERFORMANCE OBJECTIVE NO. 75

TASK: Cut external threads with lathe

STANDARD: Threads must be cut to meet a class 2A fit.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Blueprint	Lubricant
Precision measurement instruments	Centers
Combination drill	Countersink
Cutters	Drill chuck and key (Jacobs)
Single point threading tool	Thread center gage
Tool holder	Workpiece
Lathe dog	Center gage
	Thread pitch gage

PERFORMANCE GUIDE:

1. Chuck workpiece in lathe.
2. Select and set speed.
3. Face and center drill workpiece.
4. Secure workpiece between centers.
5. Set compound rest to specifications.
6. Mount and align cutter tool bit.
7. Square threading tool with workpiece using center gage.
8. Make chase dial selection (even or odd pitches).
9. Turn machine on and advance compound rest to cut .001 from stock and engage half nut lever (carriage is moving).
10. Disengage half nut lever when thread is to its length and back off cross feed screw. Return carriage to starting position and check thread pitch.
11. Synchronize thread facing dial and half nut lever at witness mark on threading dial for next cut.
12. Repeat steps 10 and 11 until thread has correct pitch diameter.

DUTY: OPERATING LATHES

PERFORMANCE OBJECTIVE NO. 76

TASK: Cut internal tapered surfaces

STANDARD: Tapered surface must be cut to a number three Morse taper.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Blueprint
Boring bar with tool & holder
Combination drill and countersink
Drill chuck and key (Jacobs)
3-jaw chuck and key

Lathe taper attachment
Workpiece
Drills
Facing tool
Tool holder

PERFORMANCE GUIDE:

1. Chuck workpiece in lathe.
2. Select and set speeds.
3. Face and center drill workpiece.
4. Step drill to blueprint specifications.
5. Mount boring bar holder and boring bar with tool on compound rest.
6. Position boring bar and tool to blueprint specifications.
7. Adjust lathe taper attachment.
8. Turn taper and check for accuracy.
9. Make adjustments as needed.

DUTY: OPERATING LATHES

PERFORMANCE OBJECTIVE NO. 77

TASK: Die cut threads with lathe

STANDARD: Threads must meet a class 2A fit.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Blueprint
Cutting oil
Dies
Diestock
Turning tool
Tool holder

Nut (test)
Releasing type die holder
Ring thread gage
Round stock
Mill file

PERFORMANCE GUIDE:

Using Die Stock - Hand Operated

1. Chuck round stock in lathe.
2. Select and mount die in diestock.
3. Align die to round stock.
4. Lubricate and hand thread stock to specifications.

Using Self-Opening Stationary Die Head

1. Chuck round stock in lathe.
2. Set compound rest to 45° and chamfer stock.
3. Select and mount die in diestock.
4. Align die to die stock by using the quill on tailstock lathe.
5. Place lathe in low gear (power off).
6. Apply cutting oil.
7. Turn diestock handle until two-three threads are made.
8. Reverse diestock to break chips.
9. Use test nut for trial fit.

DUTY: OPERATING LATHES

PERFORMANCE OBJECTIVE NO. 78

TASK: Die cut threads with lathe using die heads

STANDARD: Threads must meet a class 2A fit.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Blueprint
Cutting oil
Die heads
Dies
Turning tool

Lathe
Nut (test)
Ring thread gage
Round stock
Tool holder

PERFORMANCE GUIDE:

1. Chuck round stock in lathe.
2. Chamfer end of stock.
3. Select and mount die in acorn die holder.
4. Align die to round stock.
5. Select and set speed.
6. Lubricate and thread round stock to specification.

DUTY: OPERATING LATHES

PERFORMANCE OBJECTIVE NO. 79**TASK:** Drill holes with lathe**STANDARD:** The accuracy of the drilled hole within .001" for drills of 1/8" to 1" diameters is: maximum oversize = $0.005 + 0.005D$; minimum oversize = $0.001 + 0.003D$, where D=nominal drill diameter in inches.**SOURCE FOR STANDARD:** Writing team of incumbent workers**CONDITIONS FOR PERFORMANCE OF TASK:**

Blueprint
Combination drill and countersink
Drills
Lathe
Lubricant
Precision measurement instruments
Workpiece
3 jaw chuck and key

Jacobs chuck and key
Facing tool
Tool holder

PERFORMANCE GUIDE:

1. Chuck workpiece in lathe.
2. Set speed.
3. Face and center drill workpiece.
4. Lubricate and drill hole.
5. Back drill out of hole occasionally to relieve chips.

DUTY: OPERATING LATHES**PERFORMANCE OBJECTIVE NO. 80**

TASK: Set up lathe and face workpiece

STANDARD: Face off 1/16" to 1/8" from workpiece and until ends are square to axis of work.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Chuck key
Four-jaw independent chuck
Lathe
Light oil
Shop towels
Tool holder

Reference handbook
Regular facing tool
Square
Three-jaw universal chuck
Dial indicator

PERFORMANCE GUIDE:**Three-jaw Universal Chuck**

1. Clean and lightly oil threads on lathe spindle.
2. Clean threads in chuck.
3. Mount chuck on lathe spindle.
4. Mount workpiece in chuck.
 - a. check for true running
5. Mount regular turning tool in tool holder.
6. Adjust angle of tool holder and turning tool to center of workpiece.
7. Lock carriage to the bed.
8. Select and set speed and feed.
 - a. hand feed with cross feed
9. Face material removing 1/16" to 1/8" in successive cuts.
10. Check to insure ends are faced square to the axis of the work.

Four-jaw Independent Chuck

1. Repeat steps 1 to 3 listed under three-jaw universal chuck.
2. Mount workpiece in chuck.
3. Mount dial indicator on tool post and center workpiece.
4. Repeat steps 5 through 10 under 3-jaw universal chuck.

DUTY: OPERATING LATHES.

PERFORMANCE OBJECTIVE NO. 81

TASK: Perform contour, angular, or radii cuts with lathe

STANDARD: Lengths must be plus or minus $1/64"$, diameter must be to blueprint specifications, and angular cuts must be within 5 degrees, plus or minus 5'.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Blueprint
Cutting tool
Hermaphrodite calipers
Lathe
Micrometer calipers
Tool holder

Radius gage
Steel rule
Vernier bevel protractor
Workpiece
3-jaw chuck and key

PERFORMANCE GUIDE:

1. Secure workpiece in 3-jaw chuck.
2. Determining cutting operation.
 - a. set speed
 - b. select formed radii tool
 - c. lay out, if necessary
3. Mount tool holder and radii tool in tool post holder.
4. Perform cutting operations to specifications.

DUTY: OPERATING LATHES

PERFORMANCE OBJECTIVE NO. 82

TASK: Perform lathe filing

STANDARD: File must leave .001" for polishing.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Blueprint

File card and brush

File handles

Lathe

Chalk

Micrometer caliper

Workpiece

Files

PERFORMANCE GUIDE:

1. Follow safety practices.
2. Secure workpiece in lathe.
3. Select and set speed.
4. Select correct file.
5. Start filing operation.
 - a. file left handed
 - b. use even strokes with light pressure
6. Complete filing operation.

DUTY: OPERATING LATHES

PERFORMANCE OBJECTIVE NO. 83

TASK: Perform lathe filing to deburr part

STANDARD: Filing must remove previous tool marks.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

File card and brush
File handles
Files
Lathe
Chalk
Workpiece
3-jaw chuck and key

PERFORMANCE GUIDE:

1. Follow safety practices. (file left handed)
2. Chuck workpiece in lathe.
3. Select and set speed. (slow)
4. Select correct file.
5. Remove all burrs.

DUTY: OPERATING LATHES

PERFORMANCE OBJECTIVE NO. 84

TASK: Perform spinning operation using forming tool

STANDARD: Spin must be within a tolerance of .005" of blueprint specifications.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Annealing equipment
Ballbearing center
Chucks - lathe
Cut metal workpiece
Follow block (die)
Job specifications

Measuring instruments
Polishing supplies
Spinning tools
Spinning tool post
Form or mandrel
Lathe

PERFORMANCE GUIDE:

1. Set up lathe for spinning.
2. Mount metal workpiece.
3. Select and set speeds.
4. Spin to job specifications.
 - a. lubricate if necessary
 - b. anneal if necessary
5. Polish or buff.

DUTY: OPERATING LATHES

PERFORMANCE OBJECTIVE NO. 85

TASK: Ream holes with lathe

STANDARD: Hole must be reamed to an accuracy of $+0.0001$ " to 0.005 " of blueprint specifications.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Blueprint
 Boring bar
 Combination drill & countersink
 3-jaw chuck
 Cutting tool
 Drills

Inside caliper
 Lathe attachments
 Micrometer caliper
 Plug gage
 Reamers and holder
 Workpiece
 Tool holder

PERFORMANCE GUIDE:

1. Chuck workpiece in lathe.
2. Select and set lathe speed.
3. Face and square workpiece.
4. Center drill workpiece.
5. Drill and/or bore hole.
6. Mount machine reamer on machine.
7. Line bored hole with reamer.
8. Feed machine reamer into bored hole with sufficient coolant.
9. Remove reamer from hole and inspect hole.

DUTY: OPERATING LATHES

PERFORMANCE OBJECTIVE NO. 86

TASK: Rechase threads on lathe

STANDARD: Workpiece must be threaded to its original pitch diameter.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Blueprint
Lathe
Lubricant
Tool holder

Single point tool
Thread center gage
Threaded workpiece

PERFORMANCE GUIDE:

1. Center or chuck workpiece in lathe.
2. Set compound rest to thread angle.
3. Mount and align single point tool to center of lathe.
4. Select even or odd pitches for chasing dial selection.
5. Set speed of lathe to low range.
6. With machine running and half nut lever engaged, correlate both cross feed and compound screw settings into the thread.
7. When tool reaches its end, disengage half nut lever and quickly turn cross feed away from thread.
8. Return carriage by hand wheel to original position.
9. Return the cross feed dial and the compound dial to its original setting and advance compound rest to a new depth.
10. Repeat steps 7 and 8.
11. Set compound dial to the desired thread depth for next cut.
12. Position the crossfeed micrometer to its original setting each time the thread tool is set for another cut.

DUTY: OPERATING LATHES

PERFORMANCE OBJECTIVE NO. 87

TASK: Rough cut and finish cut with lathe

STANDARD: Rough cut within specifications of .005" to .015". Finish cut within an accuracy of .002" for 1/4" diameter work and within .007" for 4" or larger diameter work.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Blueprint
Cutting tool
Lathe
Precision measurement instruments
Properly mounter workpiece
Tool holder
Lathe dog

PERFORMANCE GUIDE:

1. Identify workpiece material.
2. Select and set speed and feeds.
3. Mount tool holder and tool on compound rest and on center line of machine.
4. Turn to specified dimension.
5. Make piece to specifications.

DUTY: OPERATING LATHES

PERFORMANCE OBJECTIVE NO. 88**TASK:** Knurl parts with lathe**STANDARD:** Workpiece must be knurl leaving from .002" to .004" to original diameter.**SOURCE FOR STANDARD:** Writing team of incumbent workers**CONDITIONS FOR PERFORMANCE OF TASK:**

Blueprint	Properly mounted workpiece
Precision measurement instruments	Brush
Scribe	Knurling tool holder
Cutting oil	
Lathe	

PERFORMANCE GUIDE:

1. Select and mount knurling tool.
2. Lay off length of knurl.
3. Position and align knurling tool.
4. Select and set speed. (low)
5. Knurl and repeat until depth of knurl is obtained.
6. Measure diameter.
7. Clean and deburr knurl, if necessary.

DUTY : OPERATING LATHES

PERFORMANCE OBJECTIVE NO. 89

TASK: Secure tool holder, fixtures, or attachments

STANDARD: Tool holder must be held in line to complete the work job

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Blueprint
Lathe and accessories
Workpiece

PERFORMANCE GUIDE:

1. Identify material to be machined.
2. Determine machining operation.
3. Select tool, tool holder, fixture, or attachment.
4. Secure tool holder, fixture, or attachment.
5. Insure that tool, fixture, or attachment is in a fixed position.

DUTY: OPERATING LATHES

PERFORMANCE OBJECTIVE NO. 90

TASK: Set lathe speed and feed

STANDARD: Speed and feed of machine must be in accordance to machinability ratings of material.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Blueprint
Lathe and accessories
Machinery handbook
Manufacturer's operation manual
Workpiece

PERFORMANCE GUIDE:

1. Identify workpiece (material, condition, hardness, rigidity).
2. Identify cutting tool (material, tool life desired, geometry, cutting fluid influence, hardness, grade).
3. Select cutting speed (considering: feed rate, depth of cut, correction factor).
4. Set up speed and feed.
 - a. calculate feed of lathe
 - b. set lathe speeds and feeds

DUTY: OPERATING LATHES

PERFORMANCE OBJECTIVE NO. 91**TASK:** Set up engine lathe**STANDARD:** Engine lathe guards must be in place, lathe clean, and lubricated.**SOURCE FOR STANDARD:** Writing team of incumbent workers**CONDITIONS FOR PERFORMANCE OF TASK:**

Blueprint
Cleaner
Precision measurement instruments
Lathe and accessories

Manufacturer's manual
Workpiece
Fixtures
Lubricant

PERFORMANCE GUIDE:

1. Clean and lubricate lathe.
2. Check all guards.
3. Inspect belt tension and gears.
4. Check carriage movement.
5. Select and secure work holding devices.
6. Select and adjust speed and feed.
7. Align centers.
8. Select and secure proper tool, fixture or attachment.
9. Secure workpiece.
10. Follow safety practices.
11. Check setup.

DUTY: OPERATING LATHES

PERFORMANCE OBJECTIVE NO. 92

TASK: Set up turret lathe.

STANDARD: Turret lathe must be clean, lubricated, and all guards secured.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Blueprint
Precision measurement instruments
Lathe tools
Lubricant
Manufacturer's manual

Fixtures and attachments
Turret lathe and accessories
Work holding devices
Workpiece

PERFORMANCE GUIDE:

1. Clean and lubricate lathe.
2. Check all guards.
3. Inspect belt tension and gears.
4. Check carriage movement.
5. Select and secure work holding devices.
6. Select and adjust speed and feed.
7. Select tools, fixtures, or attachments.
8. Insert and position tools in turret.
9. Secure workpiece.
10. Check set up.

DUTY: OPERATING LATHES

PERFORMANCE OBJECTIVE NO. 93

TASK: Tap threads with lathe

STANDARD: Threads must meet a class 2B fit.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Blueprint	Hand taps
Combination drill	Lathe and accessories
Countersink	Lubricant
Cutting tool	Tap wrench
Precision measurement instruments	Workpiece
Drills and drill chuck and key (Jacobs)	"go and no-go" thread gages
Universal 3-jaw chuck and key	

PERFORMANCE GUIDE:

1. Secure and true workpiece in chuck.
2. Face and square workpiece.
3. Center drill workpiece.
4. Chamfer workpiece.
5. Drill tap drill hole.
6. Select and secure tap and tap wrench.
7. Align tap to hole.
8. Tap hole to specifications.
9. Remove burrs.
10. Measure workpiece.
11. Check taped hole with thread gage.

DUTY: OPERATING LATHES

PERFORMANCE OBJECTIVE NO. 94

TASK: Set up tool post grinder

STANDARD: Grinder must meet SFPM to produce surface finish to 63 micro finish.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Blueprint
Diamond point dresser
Lathe and accessories
Grinding wheel
Tool post grinder

PERFORMANCE GUIDE:

1. Check wheel for cracks (replace if cracked).
2. Mount tool post grinder.
3. Cover and protect V-ways with cloth.
4. Protect lathe spindle bearing.
5. Dress and true grinding wheel.
6. Check setup.
7. Grind workpiece to specifications.

DUTY: OPERATING MILLING MACHINES

PERFORMANCE OBJECTIVE NO. 95

TASK: Align milling machine fixtures

STANDARD: Vise must be aligned to within .001" total runout.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Clamping bolts
Dial indicator and attachment
Plastic mallet
Vise
Wrench

PERFORMANCE GUIDE:

1. Clean and place vise on bed.
2. Align vise by square.
3. Fasten vise to bed with clamping bolts.
4. Put dial indicator attachment in mill spindle or magnetic tool holder.
5. Fasten dial indicator to attachment.
6. Indicate the fixed vise jaw by moving cross feed in and out with indicator.

DUTY: OPERATING MILLING MACHINES

PERFORMANCE OBJECTIVE NO. 96

TASK: Align milling machine attachments**STANDARD:** The 90 degree milling attachment must be aligned to within .001" per 4".**SOURCE FOR STANDARD:** Writing team of incumbent workers**CONDITIONS FOR PERFORMANCE OF TASK:**

Dial indicator
Extended arbor
Hex wrench
Magnetic base post.

Mill wrench
90 degree milling attachment
Plastic mallet
Draw bar

PERFORMANCE GUIDE:

1. Insert drawbar with extended arbor into column.
2. Draw arbor quill approximately 3 inches and lock.
3. Insert 90 degree attachment driver in quill and tighten drawbar, aligning key with keyway.
4. Position indicating surface parallel with table movement.
5. Snug the two housing clamp bolts.
6. Attach magnetic base with indicator.
7. Indicate the 90 degree milling attachment for parallel alignment with table movement.
8. Secure housing clamp bolts.
9. Recheck step 7 for accuracy.

DUTY: OPERATING MILLING MACHINES

PERFORMANCE OBJECTIVE NO. 97**TASK: Assemble mill work**

STANDARD: Mill work must be assembled to manufacturing and engineering specifications.**SOURCE FOR STANDARD:** Writing team of incumbent workers**CONDITIONS FOR PERFORMANCE OF TASK:**

Assembly drawing

Blueprint

Completed pieces of mill work

Precision measurement instruments

Tools

PERFORMANCE GUIDE:

1. Study blueprint and assembly drawing.
2. Determine tools needed.
3. Assemble all parts; lubricate if necessary.
4. Make adjustments if necessary.
5. Clean work station.

DUTY: OPERATING MILLING MACHINES

PERFORMANCE OBJECTIVE NO. 98

TASK: Bore holes with milling machines

STANDARD: Bore hole to blueprint specifications. An accuracy of .005" is required for production work.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Blueprint	Holding fixtures
Boring attachments	Layout die
Combination drill	Micrometer caliper
Countersink	Mill wiggler
Drills	Plug gage
Dividers	Vertical mill and accessories
Workpiece	Boring head
Drill chuck and key	

PERFORMANCE GUIDE:

1. Layout hole location.
2. Secure workpiece to table.
3. Insert chuck in spindle.
4. True mill wiggler to center of punched hole.
5. Countersink hole with a #4 countersink drill.
6. Insert drill in chuck.
7. Select speed and feed.
8. Drill hole to within .015 to .030 of designated size.
9. Insert boring head with boring bar.
10. Bore hole.

DUTY: OPERATING MILLING MACHINES

PERFORMANCE OBJECTIVE NO. 99**TASK:** Bore for a finish bushing fit.**STANDARD:** Bore must be to a press of its basic outside diameter size.**SOURCE FOR STANDARD:** Writing team of incumbent workers**CONDITIONS FOR PERFORMANCE OF TASK:**

Blueprint	Boring attachment
Precision measurement instruments	Boring tool
Vertical mill with accessories	Centering device
Workpiece with bushing to be bored	Holding device

PERFORMANCE GUIDE:

1. Mount and align holding device.
2. Secure workpiece in holding device.
3. Mount boring attachment and true to hole.
4. Select and mount boring tool.
5. Set speed and feed.
6. Bore to specifications.

DUTY: OPERATING MILLING MACHINES**PERFORMANCE OBJECTIVE NO. 100****TASK: Bore to remove bushings****STANDARD:** Hole must be bored to new bushing, with a press fit for basic O.D. size of bushing.**SOURCE FOR STANDARD:** Writing team of incumbent workers**CONDITIONS FOR PERFORMANCE OF TASK:**

Blueprint
Boring attachment
Boring tool
Bushings
Centering device
Holding device

Machinery handbook
Micrometer calipers
Cutting oil
Plug gage
Workpiece with frozen bushing
Vertical milling machine

PERFORMANCE GUIDE:

1. Mount and align holding device.
2. Secure workpiece to holding device.
3. Mount boring attachment and true to bushing.
4. Select and mount boring tool.
5. Set speed and feed.
6. Apply cutting oil.
7. Bore to remove bushing
8. Bore hole to new bushing specifications.

DUTY: OPERATING MILLING MACHINES

PERFORMANCE OBJECTIVE NO. 101

TASK: Cut external keyway

STANDARD: Mill an external keyway to blueprint specifications.
Accuracy must be depth $\begin{matrix} +0.005" \\ -0.000" \end{matrix}$ length plus or minus .010"
centerline position plus or minus 0.005" from end of workpiece.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Blueprint
Cutter
Cutting oil
Precision measurement instruments
Work holding device (vise)
Workpiece

Vertical milling machine
and accessories
Chuck

PERFORMANCE GUIDE:

1. Mount, secure, and align vise to table.
2. Select, mount and secure cutter.
3. Set machine speed.
4. Set center line of cutter on center line of shaft, close to work holding device.
5. Turn machine on and touch off.
6. Apply cutting oil.
7. Mill to prescribed depth and length.

DUTY: OPERATING MILLING MACHINES

PERFORMANCE OBJECTIVE NO. 102

TASK: Drill holes with milling machine

STANDARD: Holes must be within plus or minus .005 center to center holes.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Blueprint	Plastic mallet
Vertical milling machine & accessories	Combination countersink drill
Precision measurement instruments	Drill chuck
Work holding device	Drills
Wiggler	Lubricant
Workpiece	Dial indicator

PERFORMANCE GUIDE:

1. Mount and align holding devices.
2. Secure part in holding device.
3. Set machine speed.
4. Center punch first hole.
5. Place wiggler in chuck. Align wiggler in center hole with machine on using dial indicator.
6. Bring x and y axis of machine to zero (by slipping micrometer collars).
7. Place chuck in spindle and center drill first hole.
8. Remove center drill and insert drill into chuck.
9. Apply lubricant and drill hole. Make sure chips are coming out of hole.
10. Move x or y position to next hole by micrometer collars.

DUTY: OPERATING MILLING MACHINES

PERFORMANCE OBJECTIVE NO. 103

TASK: Inspect completed mill work.

STANDARD: Mill work must meet maximum material condition and clearance.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Blueprint
Completed mill parts
Precision measurement instruments

PERFORMANCE GUIDE:

1. Inspect parts for visible flaws.
2. Determine limits, tolerance, and/or allowance for parts.
3. Inspect interchangeable parts for maximum material condition (MMC) and clearance.
4. Inspect finish of all parts.
5. Pass or reject parts.

DUTY: OPERATING MILLING MACHINES

PERFORMANCE OBJECTIVE NO. 104**TASK:** Mill an angle**STANDARD:** Angle must be within plus or minus 5 minutes of blueprint specifications.**SOURCE FOR STANDARD:** Writing team of incumbent workers**CONDITIONS FOR PERFORMANCE OF TASK:**

Precision angle plate $45^{\circ} \pm 5'$
Blueprint
Mill and accessories
Precision measurement instruments
End mill

Vernier bevel protractor
Work holding device
Pre-machined workpiece
Collet

PERFORMANCE GUIDE:

1. Identify and classify material of workpiece.
2. Mount and align angle plate parallel to table.
3. Select and mount end mill cutter.
4. Select and set speed, feed, and depth of cut.
5. Make cut.
6. Check surface and tolerance specifications, adjusting machine as necessary.
7. Measure and inspect workpiece.

DUTY: OPERATING MILLING MACHINES

PERFORMANCE OBJECTIVE NO. 105**TASK:** Mill an external radius**STANDARD:** Mill radius must be within a tolerance of plus or minus .010" of blueprint specifications.**SOURCE FOR STANDARD:** Writing team of incumbent workers**CONDITIONS FOR PERFORMANCE OF TASK:**

Blueprint	Prepared workpiece
Dial indicator	Step blocks
End mill cutter	Straddle clamps
Mill & accessories	T-bolts
Mill wiggler	Vernier calipers
Precision measurement instruments	Cutting oil

PERFORMANCE GUIDE:

1. Identify material of workpiece.
2. Mount turntable.
3. Center spindle over center line of turntable.
4. Align and clamp workpiece to turntable.
5. Select and mount clamp.
6. Select and set speed, feed, and depth of cut.
7. Move x or y axis of table from centerline of turntable to desired radius.
8. Apply cutting oil and rough cut.
9. Measure radius and readjust if needed.
10. Check surface finish and mill to specifications.

DUTY: OPERATING MILLING MACHINES

PERFORMANCE OBJECTIVE NO. 106

TASK: Mill cylindrical workpiece

STANDARD: Cylindrical workpiece must be milled to a tolerance of $\pm .010$ of blueprint specifications.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Blueprint
Cylindrical workpiece
Precision measurement instruments
Work holding devices

Cutter
Vertical mill and accessories

PERFORMANCE GUIDE:

1. Identify material of workpiece.
2. Clamp and align turntable.
3. Clamp and align workpiece.
4. Select and mount cutter.
5. Select and set speed, feed, and depth of cut.
6. Touch-off and mill to specifications.
7. Inspect surface and measure workpiece for accuracy.

DUTY: OPERATING MILLING MACHINES**PERFORMANCE OBJECTIVE NO. 107****TASK:** Mill spur gears**STANDARD:** Gear must be milled to mesh with other gear.**SOURCE FOR STANDARD:** Writing team of incumbent workers**CONDITIONS FOR PERFORMANCE OF TASK:**

Blueprint	Mandrel
Dividinghead	Mill and accessories
Precision measurement instruments	Gear blank
Gear tooth cutter	Tailstock
Machinery handbook	Driving dog

PERFORMANCE GUIDE:

1. Press gear blank on mandrel.
2. Mount dividinghead and tailstock on mill.
3. Center and secure mandrel to dividinghead.
4. Select correct number and diametrical pitch series for number of teeth on gear blank.
5. Secure cutter to mill.
6. Determine and set indexing head to correct divisions.
7. Center gear blank to cutter.
8. Select and set speed, feed, and depth of cut.
9. Cut gear to specifications.

DUTY: OPERATING MILLING MACHINES

PERFORMANCE OBJECTIVE NO. 108

TASK: Mill internal slots using slotter and attachments

STANDARD: Mill slots must be milled to a tolerance of $+0.010''$
of blueprint specifications. $-0.000''$

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Blueprint
Precision measurement instruments
Slotting attachment
Slotting cutter
Vertical mill with accessories
Work holding device
Workpiece

PERFORMANCE GUIDE:

1. Identify material of workpiece.
2. Secure workpiece to work holding device.
3. Select and secure cutter to spindle.
4. Select and adjust stroke length.
5. Align cutter to workpiece.
6. Set speed.
7. Slot to specifications.

DUTY: OPERATING MILLING MACHINES

PERFORMANCE OBJECTIVE NO. 109

TASK: Perform end milling

STANDARD: Milled surface must be relatively free of deep tool marks.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Blueprint	Plastic mallet or lead hammer
Precision measurement instruments	Collet
End mills	Work holding device
Vertical mill and accessories	Workpiece with layout lines

PERFORMANCE GUIDE:

1. Identify material of workpiece.
2. Mount and align vise.
3. Secure workpiece in work holding device.
4. Select and mount end mill.
5. Select and set speed and feed.
6. Align workpiece, touch off, and set depth of cut on quill.
7. Mill to prescribed lines, measure for accuracy, and make necessary adjustments.
8. Mill to specifications.

DUTY: OPERATING MILLING MACHINES

PERFORMANCE OBJECTIVE NO. 110

TASK: Perform flycut

STANDARD: Flycut bar must be squared and parallel to within $\pm .010$ square of blueprint specifications.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Blueprint	Plastic mallet
Dial indicator	Work holding device
Flycutter	Workpiece
Precision measurement instruments	Milling machine & accessories
Collet	

PERFORMANCE GUIDE:

1. Identify material of workpiece.
2. Mount and align work holding device.
3. Secure workpiece in work holding device.
4. Select and mount flycutter in collet.
5. Select and set speed and feed.
6. Align cutter to workpiece, touch-off, and set depth of cut.
7. Mill surface A.
8. Remove workpiece, deburr, rotate workpiece 180°, and secure in work holding device. Workpiece must be firmly seated on first milled surface (for squareness).
9. Mill opposite surface (B).
- ✓ 10. Position first milled surface against squared fixture, and mill surface C.
11. Mill surface D.
12. Measure for accuracy of cut.

DUTY: OPERATING MILLING MACHINES

PERFORMANCE OBJECTIVE NO. 111

TASK: Perform index

STANDARD: Index workpiece must be to within ± 1 minute in 360° of blueprint specifications.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Aligning devices	Blueprint
Milling machine & accessories	Dividinghead and accessories.
Precision measurement instruments	Work holding device
Milling cutter	Workpiece
Machinist handbook	

PERFORMANCE GUIDE:

1. Identify material of workpiece.
2. Mount and align dividinghead.
3. Select and mount cutter.
4. Mount and align work holding device and workpiece.
5. Determine number of indexes workpiece must be rotated.
6. Set up indexing unit of dividinghead.
 - a. select appropriate indexing plate
 - b. mount indexing plate to dividerhead
 - c. secure index sector arms
7. Select and set speed and feed.
8. Touch off, make primary cut, and adjust for depth of cut.
9. Measure for blueprint specifications.
10. Recut, if necessary.
11. Rotate indexing unit for each cut specified.
12. Inspect and measure finished part to blueprint specifications.

DUTY: OPERATING MILLING MACHINES

PERFORMANCE OBJECTIVE NO. 112**TASK:** Perform reaming operations**STANDARD:** A tolerance of $+0.0001"$ to $+0.0005"$ is required for reamed hole.**SOURCE FOR STANDARD:** Writing team of incumbent workers**CONDITIONS FOR PERFORMANCE OF TASK:**

Blueprint

Chuck

~~Combination drill and countersink~~

Drills

Precision measurement instruments

Reamers

Work holding device

~~Workpiece~~

Lathe

PERFORMANCE GUIDE:

1. Identify material of workpiece.
2. Mount and align work holding device.
3. Secure and align workpiece.
4. Select and set speed and feed.
5. Center drill workpiece.
6. Drill workpiece to specifications.
7. Ream hole to specifications.

DUTY: OPERATING MILLING MACHINES

PERFORMANCE OBJECTIVE NO. 113

TASK: Perform cutting-off operation

STANDARD: Cut off operations must be performed to within a tolerance of $\pm 1/64$ " of blueprint specifications.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Arbor and collars	Work holding device
Precision measurement instruments	Workpiece
Assortment of cutters	Blocks
Blueprint	Horizontal milling machine

PERFORMANCE GUIDE:

1. Identify material of workpiece.
2. Mount and align workpiece in work holding device.
3. Select and mount cutter.
4. Select and set speed, feed, and depth of cut.
5. Align workpiece to cutter.
6. Perform milling operation to blueprint specifications.
7. Measure finished part for accuracy.

DUTY: OPERATING MILLING MACHINES

PERFORMANCE OBJECTIVE NO. 114

TASK: Perform straddle milling operations on the horizontal mill

STANDARD: Workpiece must be milled to an accuracy of 0.002" of blueprint specifications.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Blueprint	Milling machine & accessories
Feeler gage	Parallels
Lead hammer	Rule
Micrometer caliper	Scribers
Milling machine arbor with spacers	Side milling cutters
Square	Vise
Workpiece	

PERFORMANCE GUIDE:

1. Identify material of workpiece.
2. Secure vise to machine table.
3. Select, mount, measure, and align cutters.
4. Mount workpiece.
5. Select and set speed and feed.
 - a. use conventional milling
6. Align cutters to workpiece.
7. Make preliminary cut.
8. Measure and make adjustments as necessary.
9. Mill to specifications and inspect workpiece.

DUTY: OPERATING MILLING MACHINES

PERFORMANCE OBJECTIVE NO. 115

TASK: Set speeds and feeds for milling work

STANDARD: Speed and feed must meet for machinability rating of workpiece.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Blueprint
Machinery handbook
Manufacturer's operation manual for milling machine
Milling machine

PERFORMANCE GUIDE:

Speed

1. Identify material to be machined.
2. Identify cutter to be used.
3. Determine condition of milling machine.
4. Determine depth of cut.
5. Establish material cutting speed.
6. Determine speed setting for machine using tables in handbook.
7. Set up speed according to operation manual.

Feed

1. Repeat step 1 to 4 under speed.
2. Determine feed using tables in handbook.
3. Set up feed according to operation manual.

DUTY: OPERATING MILLING MACHINES**PERFORMANCE OBJECTIVE NO. 116**

TASK: Square workpiece using dividinghead (40:1)

STANDARD: Workpiece must be square within .005" of blueprint specifications.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Arbor	Scrap workpiece
Milling machine with accessories	Side cutter
Blueprint	Soft-faced hammer
Chuck	Square
End mill cutter	Workpiece
Precision measurement instruments	Dividinghead

PERFORMANCE GUIDE:

1. Identify workpiece material.
2. Mount and position dividinghead on machine table.
3. Secure dividinghead in vertical position.
4. Mount and align scrap workpiece in dividinghead.
5. Mount and secure end mill cutter in chuck or mount and secure side cutter on arbor.
6. Select and set speed and feed.
7. Make cut to desired depth.
8. Turn off cutter, rotate crank handle 10 turns, turn cutter back on, and make cut to desired depth.
9. Reposition cutter and repeat step 8.
10. Step 8 is to be completed four times until workpiece is finished.
11. Check for squareness and accuracy.

DUTY: OPERATING MILLING MACHINES

PERFORMANCE OBJECTIVE NO. 117

TASK: Square up metal using table vise

STANDARD: Workpiece must be squared to within $\pm .005$ " parallel.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Arbor	Shim stock
Blueprint	Soft-faced hammer
Mill cutter	Square
Milling machine with accessories	Vise
Precision measurement instruments	Workpiece

PERFORMANCE GUIDE:

1. Identify workpiece material.
2. Mount and position vise.
3. Select and mount cutter.
4. Select and set up speed and feed.
5. Mount and align workpiece to cutter.
6. Make first cut.
7. Turn off cutter, measure for accuracy, and rotate workpiece to finished side against fixed jaw, and secure.
8. Make second cut to depth.
9. Measure for accuracy and place workpiece so that second finished surface is on the bottom of the vise.
10. Make third cut.
11. Turn off cutter, measure for accuracy, and rotate workpiece.
12. Cut remaining side.
13. Measure for squareness and accuracy.

DUTY: OPERATING POWER SAWS

PERFORMANCE OBJECTIVE NO. 118

TASK: Weld bandsaw blades to insert for contour welding.

STANDARD: Butt weld must not have weld cracks and overlap joints.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Bandsaw with butt welder and grinder
Drilled workpiece
Machinery reference manual

PERFORMANCE GUIDE:

1. Cut off electrical power to saw.
2. Remove blade tension.
3. Cut blade.
4. Inset blade properly through workpiece.
5. Butt weld blade.
6. Inspect blade for proper weld.
7. Anneal weld point.
8. Grind weld.
9. Remount blade and adjust blade tension.

DUTY: OPERATING POWER SAWS

PERFORMANCE OBJECTIVE NO. 119**TASK:** Measure and cut off material with power hacksaw**STANDARD:** Material must be cut off to within a tolerance of $\pm 1/16"$ of blueprint specifications.**SOURCE FOR STANDARD:** Writing team of incumbent workers**CONDITIONS FOR PERFORMANCE OF TASK:**

File
Floor stand
Job specifications
Power hacksaw

Scribe
Steel rule
Workpiece
Saw vise

PERFORMANCE GUIDE:**Measure and Mark Material**

1. Refer to job specifications for dimensions.
2. Measure to dimensions.
3. Mark location with file or scribe.

Cut Off Material

1. Secure material in saw vise.
 - a. support with floor stand if necessary
2. Lower saw to workpiece.
3. Adjust material to required length (allow $1/16"$ for cut).
4. Lock material in vise.
5. Adjust gauge or stop.
6. Lower saw to material.
7. Adjust coolant nozzle.
8. Saw to specifications (allow $1/16"$ tolerance).

DUTY: OPERATING POWER SAWS

PERFORMANCE OBJECTIVE NO. 120

TASK: Remove and replace saw blades

STANDARD: Blade must be tight to prevent damage. Teeth must be in direction of cut to be made.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Blades
Hand tools
Power hacksaw

Reference handbook
Metal band saw

PERFORMANCE GUIDE:

Power Hacksaw

1. Select saw blade.
2. Cut off all electrical power.
3. Release tension clamp.
4. Remove and store blade.
5. Adjust for length of new blade.
6. Insert new blade in frame.
7. Check to insure teeth point in direction of cut to be made.
8. Tighten blade in frame.

Metal Band Saw

1. Select saw blade.
2. Cut off all electrical power.
3. Release tension on blade.
4. Remove blade.
5. Loop blade for storage.
6. Check guides, replace if necessary.
7. Unwind new blade.
8. Install new blade.
9. Apply proper tension to blade and inspect for blade direction and guide seating.

DUTY: OPERATING POWER SAWS

PERFORMANCE OBJECTIVE NO. 121**TASK:** Saw scribed lines**STANDARD:** Workpiece must be sawed to within $\pm 1/16$ " of job specifications.**SOURCE FOR STANDARD:** Writing team of incumbent workers**CONDITIONS FOR PERFORMANCE OF TASK:**

Job specifications
Measurement instruments
Metal band saw with accessories
Support and holding devices
Workpiece

PERFORMANCE GUIDE:

1. Check scribed lines for clarity.
2. Mount and align machine guide.
3. Check to see that correct blade is attached.
4. Determine and set correct cutting speed.
5. Adjust and clamp saw guide.
6. Select and secure holding device.
7. Perform sawing operation.
 - a. support workpiece if necessary
 - b. align scribed line to blade
 - c. advance workpiece into saw with steady pressures
 - d. saw to specifications

DUTY: OPERATING POWER SAWS

PERFORMANCE OBJECTIVE NO. 122

TASK: Set speeds and feeds for sawing operations

STANDARD: Speed and feed must have machinability rating of workpiece.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Description of workpiece
Job specifications
Machinery handbook
Manufacturer's operation manual

PERFORMANCE GUIDE:

1. Determine material to be sawed.
 2. Determine type of saw to be used.
 3. Determine speed and feed requirements.
 4. Set machine speed and feed according to manufacturer's operation manual.
-

DUTY: OPERATING POWER SAWS

PERFORMANCE OBJECTIVE NO. 123

TASK: Select and install saw blades

STANDARD: Blades used must be appropriate to material variables.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Job specifications
Reference handbook
Selection of saw blades
Workpiece

PERFORMANCE GUIDE:

1. Identify kind of material of workpiece.
 2. Identify shape and thickness of workpiece.
 3. Select blade requirements of appropriate pitch from reference table.
 4. Determine length, width, and thickness of blade.
 5. Select appropriate blade.
-

DUTY: OPERATING PRESSES

PERFORMANCE OBJECTIVE NO. 124

TASK: Set up and punch materials with press

STANDARD: Parts must be punched to die specifications.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Blueprint
Jig and punch
Scale or tape
Workpiece material

PERFORMANCE GUIDE:

1. Calculate amount of force required.
2. Secure jig to press table.
3. Secure punch to ram.
4. Hand align jig for table and part clearance.
5. Visually inspect jig mount and punch clearance for safety.
6. Place material in jig.
7. Turn on power to press.
8. Punch part.
- ~~9. Inspect and measure part for accuracy according to blueprint.~~
10. Readjust jig, if necessary.
11. Produce desired number of parts.
12. Calculate amount of force required.

DUTY: OPERATING PRESSES

PERFORMANCE OBJECTIVE NO. 125

TASK: Select accessories and attachments

STANDARD: Punch accessories and attachments must have capacity to finish operations.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Blueprint

Selection of accessories and attachments

PERFORMANCE GUIDE:

1. Review blueprint for parts to be punched.
2. Select correct attachments and accessories as indicated by specifications.

DUTY: OPERATING PRESSES

PERFORMANCE OBJECTIVE NO. 126

TASK: Set up press and assemble parts

STANDARD: Assembled parts must be fastened securely.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Blueprint
Clamps
Lubricant
Parts to be assembled
Precision measurement instruments
Press

PERFORMANCE GUIDE:

1. Place and clamp stationary part to table.
 2. Align moveable part with stationary part.
 3. Lubricate both parts.
 4. Turn on power to press.
 5. Lower ram to moveable part.
 6. Check hydraulic pressure of operation.
 7. Check for galling.
 8. Press and assemble to tolerance specified on blueprint, following proper sequence.
-

DUTY: OPERATING PRESSES

PERFORMANCE OBJECTIVE NO. 127

TASK: Set up press and disassemble parts

STANDARD: Parts must be disassembled following sequence on assembly drawing.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Assembly drawing
Blueprint
Clamps
Lubricant
Part to be disassembled
Press

PERFORMANCE GUIDE:

1. Place and clamp stationary part to table.
 2. Align moveable part to ram.
 3. Lubricate both parts.
 4. Turn on power to press.
 5. Lower ram to moveable part.
 6. Disassemble according to sequence on blueprint.
 7. Apply pressure to moveable part.
 8. Check for galling.
-

DUTY: OPERATING PRESSES

PERFORMANCE OBJECTIVE NO. 128

TASK: Straighten miscellaneous parts with presses

STANDARD: Bent part must be straightened parallel to press bed to an accuracy of plus or minus 1/64".

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Bar flat or reel
Bent shaft
Jigs
Rule
Spacers
Straight edge

Dial indicator with base

PERFORMANCE GUIDE:

1. Place bent part between spacers.
2. Use appropriate jig, if necessary.
3. Press part to straighten to a parallel tolerance of plus or minus 1/64".
4. Check part by rotating part. Use dial indicator.

DUTY: OPERATING PRESSES

PERFORMANCE OBJECTIVE NO. 129

TASK: Set up, remove, and replace parts

STANDARD: Part must be reassembled to a tolerance of plus or minus 1/64".

SOURCE FOR STANDARD: Writing team of incumbent workers

~~CONDITIONS FOR PERFORMANCE OF TASK:~~

Blueprint
Clamps
Gears
Key

Lubricant
Measuring instrument
Pulley or wheel
Shaft cut with keyway

~~PERFORMANCE GUIDE:~~

1. Perform set up.
 - a. take and record measurement of position of part to be removed
 - b. align moveable part with ram
2. Remove part(s).
 - a. lubricate both parts
 - b. turn on power
 - c. check disassembly procedures
 - d. apply pressure to remove part
 - e. remove part(s)
3. Replace part(s).
 - a. lubricate both parts
 - b. turn on power
 - c. check disassembly procedures
 - d. align keyways
 - e. apply lubricant to all parts
 - f. insert key and press parts together
 - g. check tolerance as measured in Step 1
4. Perform set up.

DUTY: OPERATING SHAPERS

PERFORMANCE OBJECTIVE NO. 130

TASK: Align shaper attachment, workpiece, and cutting tool

STANDARD: Ram stroke must clear workpiece on forward stroke by 1/4", and 1/2" on return stroke.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Aligning key stock
Blueprint
Combination set square
Cutting tool

Dial indicator
Shaper operations manual
Work holding device
Workpiece

PERFORMANCE GUIDE:

1. Secure work holding device.
 2. Mount and align key stock.
 3. Square workpiece to ram head.
 4. Replace key stock with workpiece.
 5. Adjust shaper and cutter to workpiece
 - a. adjust clapper box
 - b. adjust for clearance
 - c. adjust for length of stroke
 - d. adjust for strokes per minute
-

DUTY: OPERATING SHAPERS

PERFORMANCE OBJECTIVE NO. 131**TASK:** Set speeds and feeds of shapers**STANDARD:** Speeds and feeds of shapers must be in accordance to material variables and machinability ratings.**SOURCE FOR STANDARD:** Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Blueprint
 Machinist handbook
 References

Shaper hand tools
 Shaper operations manual
 Workpiece

PERFORMANCE GUIDE:**Select and Set Cutting Speed**

1. Identify material of workpiece.
2. Identify cutter material to be used.
3. Determine cutting speed using table specifications.
4. Determine setting of cutting speed based on desired length of cut and shaper strokes per minute.
5. Set up shaper for desired cutting speed according to operations manual.

Select and Set Feed

1. Identify material of workpiece.
 2. Identify cutter material.
 3. Determine depth of cut needed.
 4. Determine feed according to desired finish.
 5. Set feed according to operations manual.
-

DUTY: OPERATING SHAPERS

PERFORMANCE OBJECTIVE NO. 132

TASK: Select, shape, and sharpen cutting tools

STANDARD: A radius gage check must be within plus or minus 1/32" of table profile specifications, and angular measurements must be plus or minus 1/2 degree.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Blueprint
Bench grinder
Coarse and fine grinding wheels
Combination square
Coolant

Cutting tool or blanks.
Radius gage
Reference book
Wheel dresser
Workpiece

PERFORMANCE GUIDE:

Cutter Selection

1. Identify workpiece material.
2. Determine type of cut.
3. Determine profile of cutter to perform machining.
4. Select proper cutter.

Shape and Sharpen

1. Repeat steps 1 to 3 under cutter selection.
2. Select cutter for job and to fit tool holder.
3. Check and dress grinding wheel.
4. Grind tool to rough shape (use coolants as needed)
5. Measure to determine finish cuts.
6. Grind tool to desired specification and sharpen.

DUTY: PERFORMING PRODUCTION MACHINIST LINE WORK

PERFORMANCE OBJECTIVE NO. 133

TASK: Remove and install pins

STANDARD: New pins must be aligned to the shaft.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Drill	Pin punches
Hammer	Pliers
Job specifications	Screw-extractor
Machinist's handbook	Workpiece
Measurement instruments	Pins

PERFORMANCE GUIDE:

Remove Taper or Straight Pin

1. Select tools to remove pin.
2. Drive out or remove pin.
3. Inspect pin for damage (replace if damaged).

Remove Damaged Straight Pin

1. Drill out pin, or
2. remove pin with screw extractor.
3. Inspect hole for damage.
4. Select replacement pin.

Install Taper or Straight Pin

1. Select pin.
2. Select installation tools.
3. Line up parts as needed.
4. Drive in pin and secure.

DUTY: PERFORMING PRODUCTION MACHINIST LINE WORK

PERFORMANCE OBJECTIVE NO. 134

TASK: Remove frozen or seized parts

STANDARD: Frozen or seized parts must be removed.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Drills

Drill press

Machine or piece of equipment with frozen or seized part

Press

Screw extractor

PERFORMANCE GUIDE:

1. Select proper removal method.
 - a. drive out part, or
 - b. drill out part, or,
 - c. drill and use screw extractor, or
 - d. press out part
 2. Remove frozen or seized part.
 3. Inspect part for damage.
 4. Forward machine or equipment to next work station.
-

DUTY: MAINTAINING MACHINES AND TOOLS

PERFORMANCE OBJECTIVE NO. 135

TASK: Inspect and change drive pulleys or belts

STANDARD: Pulley and belts must run true at all speeds.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Belts	Pulley puller
Hand tools	Pulleys
Machinery handbook	Wrenches
Maintenance manual	Measurement instruments
Fixture (belt)	Clamps

PERFORMANCE GUIDE:

1. Cut off equipment electrical power.
2. Release belt tension.
3. Inspect belt for dryness, oil saturation, wear, stretching.
4. Determine if belt needs replacement.
5. Select replacement belt.
 - a. select type (flat/Vee: A or B)
 - b. measure belt for replacement
 - c. select new belt
 - d. splice, lace new belt, or glue
6. Inspect pulley for wear, cracks, replacement.
7. Remove and replace pulley.
 - a. select type (flat/Vee: A or B)
 - b. measure for replacement
 - c. remove pulley
 - d. select new pulley
 - e. place new pulley on shaft
 - f. align pulley to shaft
8. Install original or new belt.
 - a. align shafting and pulleys
 - b. mount belt
 - c. adjust belt tension

DUTY: MAINTAINING MACHINES AND TOOLS

PERFORMANCE OBJECTIVE NO. 136

TASK: Clean and store hand tools, cutters, fixtures, jigs, or attachments

STANDARD: Items must be readily available for next job.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Brushes

Cleaning fluid

Light oil

Cutters

Attachments

Shop towels

Storage facilities

Hand tools

Fixtures

PERFORMANCE GUIDE:

1. Wipe or lightly brush away shavings, moisture, oil or grease.
2. Inspect for damage.
3. Check for operation.
4. Wipe dry.
5. Apply light oil.
6. Store in proper place.

DUTY: MAINTAINING MACHINES AND TOOLS

PERFORMANCE OBJECTIVE NO. 137

TASK: Install, level, and fasten down machines

STANDARD: Machines must be level according to master level.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Fasteners
Hand tools
Installation equipment
Master level

Maintenance manual
Operations manual
Shims
Wrenches

PERFORMANCE GUIDE:**Installation**

1. Refer to operations and maintenance manual for sequence of installation.
2. Place machine in proper location and position.
3. Connect or have connected all electrical power.
4. Connect air supply.

Leveling

1. Check level in all directions.
2. Adjust with shims or other leveling device.

Lagging Down

1. Tighten down nuts or fasteners.
2. Check level with power off.
3. Check level with power on.
4. Adjust mounting.
5. Check level in all directions.

DUTY: MAINTAINING MACHINES AND TOOLS

PERFORMANCE OBJECTIVE NO. 138

TASK: Replace and adjust machine parts

STANDARD: Parts must be replaced and adjusted in accordance with their sequence.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Cleaning materials
Equipment
Job specifications
Lubricants

Measurement instruments
Tools
Work order

PERFORMANCE GUIDE:

1. Secure and study work order and job specifications.
2. Receive inspected, repaired, or replacement part.
3. Inspect usability of part.
4. Determine and get needed tools, equipment, and measurement instruments needed.
5. Determine proper sequence for assembly.
6. Assemble all parts as required.
7. Replace all retaining fasteners.
8. Lubricate machine.
9. Make adjustments.
10. Check required machine part movement.
11. Make refinement adjustments.
12. Check machine operation in low speed.
13. Test machine in all speeds and feeds.
14. Make adjustments.
15. Clean work station and return tools and equipment to storage.

DUTY: MAINTAINING MACHINES AND TOOLS

PERFORMANCE OBJECTIVE NO. 139

TASK: Inspect and remove, replace, or adjust machine guards

STANDARD: Machine guards must be positioned to protect operator.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Hand tools
Maintenance manual
Measurement instruments
Operation manual

PERFORMANCE GUIDE:

1. Check operations and maintenance manual to account for all guards.
2. Obtain guards for those missing.
3. Inspect machine guards.
 - a. determine any defects
 - b. determine adjustments needed
 - c. remove damaged guards
4. Replace/adjust guards.
 - a. replace missing or damaged guards.
 - b. adjust guards to manufacturer's specifications

DUTY: MAINTAINING MACHINES AND TOOLS

PERFORMANCE OBJECTIVE NO. 140

TASK: Scrape and paint machines.

STANDARD: Machine surface must be painted.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Cover cloth
Machine to be painted
Paint
Paint brushes

Paint stick
Sandpaper and steel wool
Scraper
Spray primer paint

PERFORMANCE GUIDE:

1. Cover machine parts not to be painted.
2. Sand and scrape machine to bare metal, if needed.
3. Spray or brush primer coat.
4. Allow primer coat to dry.
5. Select and stir machine paint.
6. Clean paint brushes or get new ones.
7. Paint exposed area.
8. Clean brush and clamp lid back on paint can.
9. Store paint and brushes.
10. Take off cover and dispose properly.
11. Clean machine and work area.

DUTY: MAINTAINING MACHINES AND TOOLS

PERFORMANCE OBJECTIVE NO. 141

TASK: Inspect and repair hand tools

STANDARD: Tools must be maintained for proper repair work.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Broken hand tools
Job specifications
Manufacturer's standards

PERFORMANCE GUIDE:

1. Inspect hand tool and determine damage.
2. Determine if tool can be repaired.
3. Repair hand tool.
 - a. obtain needed part
 - b. dismantle hand tool
 - c. assembly hand tool with new part
 - d. adjust and check for accuracy

DUTY: MAINTAINING MACHINES AND TOOLS

PERFORMANCE OBJECTIVE NO. 142**TASK:** Store grinding wheels**STANDARD:** Wheels must be protected from damage.**SOURCE FOR STANDARD:** Writing team of incumbent workers.**CONDITIONS FOR PERFORMANCE OF TASK:**

Assortment of grinding wheels
Instructions for storage

PERFORMANCE GUIDE:

1. Transport grinding wheels to storage area observing safety procedures.
2. Store wheels in dry area with conditions of proper temperature and humidity.
3. Store wheels in appropriate racks.
4. Store wheels in order from oldest to newest.
5. Protect wheels from impact.

DUTY: MAINTAINING MACHINES AND TOOLS

PERFORMANCE OBJECTIVE NO. 143

TASK: Store precision tools

STANDARD: Tools must be stored for protection and their reliability.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

- Clean rags
- Precision tools
- Rust preventative
- Storage case
- Tool and instrument oil

PERFORMANCE GUIDE:

1. Handle all precision tools gently.
2. Inspect tools for damage.
3. Wipe surface free of dirt, grit, and oil.
4. Wipe surface dry.
5. Apply light coat of tool and instrument oil.
6. Store in proper case.

DUTY: MAINTAINING MACHINES AND TOOLS

PERFORMANCE OBJECTIVE NO. 144

TASK: Perform maintenance on lathe

STANDARD: Lathe must be reliable and dependable for immediate work.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Cleaner	Handtools
Precision measurement instruments	Lubricant
Operation manual or manufacturer's specifications	

PERFORMANCE GUIDE:

1. Inspect lathe for maintenance or repairs needed.
2. Clean lathe.
3. Lubricate lathe.
4. Perform other routine maintenance as needed.
5. Make minor repairs or adjustments as needed.

DUTY: MAINTAINING MACHINES AND TOOLS

PERFORMANCE OBJECTIVE NO. 145

TASK: Perform maintenance on milling machine

STANDARD: Milling machine must be reliable and dependable for immediate work readiness.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Cleaner	Hand tools
Precision measurement instruments	Lubricant
Operation manual or manufacturer's specifications	

PERFORMANCE GUIDE:

1. Inspect milling machine for maintenance or repair needed.
2. Clean milling machine.
3. Lubricate milling machine.
4. Perform other maintenance as needed.
5. Make minor repairs or adjustments as needed.

DUTY: MAINTAINING MACHINES AND TOOLS

PERFORMANCE OBJECTIVE NO. 146

TASK: Perform maintenance on drill press

STANDARD: Drill press must be reliable to perform all operations.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Cleaner
Lubricant
Service Manual

PERFORMANCE GUIDE:

1. Read and interpret maintenance instructions in service manual.
2. Clean, lubricate, and perform other maintenance according to instructions.
3. Adjust quill feed spring for proper tension.
4. Turn machine on and position machine to various spindle speeds.
5. Replace all covers and guards.

DUTY: MAINTAINING MACHINES AND TOOLS

PERFORMANCE OBJECTIVE NO. 147

TASK: Perform maintenance on grinder

STANDARD: Grinder must be immediately reliable and available to function satisfactorily.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Cleaner
Hand tools
Machinist's handbook

Manufacturer's specifications
Rawhide mallet

PERFORMANCE GUIDE:

1. Clean and lubricate grinding machine.
2. Test wheel for cracks, check flanges for burr.
3. Replace wheel if cracked.
4. Inspect bearings and spindle.
5. Check exhaust system connections.
6. Inspect wheel guards.
7. Inspect boundary of guard opening.
8. Inspect coolant tank and motor.

DUTY: MAINTAINING MACHINES AND TOOLS

PERFORMANCE OBJECTIVE NO. 148

TASK: Perform maintenance on band saw

STANDARD: Machine must be dependable for immediate work.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Cleaner
Lubricant
Manufacturer's operation manual

PERFORMANCE GUIDE:

1. Clean, then lubricate bearing only.
2. Inspect holding devices.
3. Check band guide for wear.
4. Check band saw blade for mounting, tension, set, and sharpness.
5. Inspect rubber tires on drive wheel and idler wheel.
6. Align idler wheel in vertical position.
7. Grease drive train in gear box.
8. Inspect power down feed (if available).

DUTY: MAINTAINING MACHINES AND TOOLS

PERFORMANCE OBJECTIVE NO. 149

TASK: Select coolants, cutting oils, or compounds.

STANDARD: Coolants must have sufficient quality to insure heat dissipation and rust preventative.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Compound
Coolant
Cutting oil

Tool engineer's handbook
Workpiece
Job specifications

PERFORMANCE GUIDE:

1. Review job specifications and handbook tables.
2. Determine machinability of workpiece.
3. Identify cutting tool material.
4. Determine machinery operation.
5. Select coolant, cutting oil, and/or compound.
6. Mix components if necessary.

DUTY: MAINTAINING MACHINES AND TOOLS

PERFORMANCE OBJECTIVE NO. 150**TASK:** Clean arbor press :**STANDARD:** Arbor press must be clean for new grease and oil.**SOURCE FOR STANDARD:** Writing team of incumbent workers**CONDITIONS FOR PERFORMANCE OF TASK:**

Brush
Cleaning rags
Cleaning solvent
Rubber gloves

PERFORMANCE GUIDE:

1. Apply cleaning solvent with brush, wearing rubber gloves.
2. Remove all oil, grease, chips, and grit from press.
3. Wipe press dry with clean rags.
4. Inspect press.

DUTY: MAINTAINING MACHINES AND TOOLS

PERFORMANCE OBJECTIVE NO. 151

TASK: Lubricate arbor press

STANDARD: Press must be greased for protection against wear.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Grease gun
Lubricants
Manufacturer's manual
Oil can

PERFORMANCE GUIDE:

1. Determine lubricants to be used.
2. Identify parts to be lubricated.
3. Lubricate parts.

DUTY: MAINTAINING MACHINES AND TOOLS

PERFORMANCE OBJECTIVE NO. 152**TASK:** Clean hydraulic press**STANDARD:** Press must be ready to receive new lubricant.**SOURCE FOR STANDARD:** Writing team of incumbent workers**CONDITIONS FOR PERFORMANCE OF TASK:**

Brush
Cleaning rags
Cleaning solvent
Rubber gloves

PERFORMANCE GUIDE:

1. Disconnect all electrical power to press.
2. Wearing rubber gloves apply cleaning solvent to working parts of press.
3. Remove all oil, grease, chips, and grit from press.
4. Wipe press dry with clean rags.
5. Inspect press.

DUTY: MAINTAINING MACHINES AND TOOLS

PERFORMANCE OBJECTIVE NO. 153**TASK:** Lubricate hydraulic press**STANDARD:** Press must be lubricated in accordance with maintenance schedule.**SOURCE FOR STANDARD:** Writing team of incumbent workers**CONDITIONS FOR PERFORMANCE OF TASK:**

Bucket
Grease gun
Lubricants

Manufacturer's manual
Oil can

PERFORMANCE GUIDE:

1. Disconnect electrical power to press.
2. Locate hydraulic fluid drain plug.
3. Drain fluid into bucket.
4. Locate, remove, and inspect filter.
5. Clean filter or replace.
6. Return filter to press.
7. Replace drain plug.
8. Locate hydraulic fluid fill caps.
9. Replace hydraulic fluid.
10. Lubricate moveable parts.
11. Hand lubricate ram.

DUTY: MAINTAINING MACHINES AND TOOLS

PERFORMANCE OBJECTIVE NO. 154**TASK:** Inspect arbor press**STANDARD:** Press must function efficiently and be dependable.**SOURCE FOR STANDARD:** Writing team of incumbent workers**CONDITIONS FOR PERFORMANCE OF TASK:**

Arbor press
Checklist for safe operation conditions

PERFORMANCE GUIDE:

1. Inspect gears for signs of excessive wear.
2. Inspect gear rack for signs of excessive wear.
3. Check bed for cracks.
4. Examine handle checking for bends.
5. Determine process for correction of deficiencies.
6. Determine whether rack can be raised to clear part.
7. Inspect rachet for wear.

DUTY: MAINTAINING MACHINES AND TOOLS

PERFORMANCE OBJECTIVE NO. 55**TASK: Inspect hydraulic press****STANDARD: Press must be readily available and operational.****SOURCE FOR STANDARD: Writing team of incumbent workers****CONDITIONS FOR PERFORMANCE OF TASK:****Hydraulic press****Checklist for safe operation conditions****PERFORMANCE GUIDE:**

1. Look for hydraulic fluid leaks.
2. Check lowering and raising cable for broken strands and placement in pulleys.
3. Examine press for bent pins.
4. Determine if holes are worn.
5. Check fluid level in hydraulic press.
6. Determine process for correction of deficiencies.
7. Check hose connections.

DUTY: MAINTAINING MACHINES AND TOOLS

PERFORMANCE OBJECTIVE NO. 156

TASK: Inspect work area for safe working environment.

STANDARD: All unsafe working conditions must be reported immediately to supervisor.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Checklist of safe working conditions
Work area

PERFORMANCE GUIDE:

1. Inspect machine tools.
 - a. safety guards
 - b. controls
 - c. ventilation
 - d. tool attachments
2. Check hand tools.
 - a. clean
 - b. storage
3. Wear personal protection equipment.
 - a. foot, eye, head protection
4. Post warning signs.
5. Identify first aid station.
6. Check floors around machines for safety markings.
 - a. clean
 - b. mark clearly

DUTY: MAINTAINING SHOP FACILITIES AND WORK AREAS

PERFORMANCE OBJECTIVE NO. 157

TASK: Dispose of scrap metal, chips, shavings, and trash or waste material

STANDARD: Scrap and waste material must be disposed of in accordance with safe practices as outlined by OSHA.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Brushes
Cleaning materials
Containers
Supplies
Scrap material and waste
Safety procedures for waste disposal

PERFORMANCE GUIDE:

1. Separate brass and aluminum chips into different containers for recycling.
2. Clean floor around chip containers.

DUTY: MAINTAINING SHOP FACILITIES AND WORK AREAS

PERFORMANCE OBJECTIVE NO. 158

TASK: Clean and maintain work area

STANDARD: Work area must be safe in accordance with OSHA standards.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Brooms
Brushes
Cleaner
Clean rags

PERFORMANCE GUIDE:

1. Turn machines off.
2. Clean machine or work area to floor level.
3. Clean and turn in all tools and equipment.
4. Clean up all oil, grease, or other liquids spilled.
5. Clear work area of all metal chips and shavings.
6. Return all metal stock to storage.
7. Place wipe cloths or waste material in disposal containers.

DUTY: READ AND INTERPRET BLUEPRINTS

PERFORMANCE OBJECTIVE NO. 159

TASK: Interpret metric blueprints

STANDARD: Blueprints must be read to specifications.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Blueprints
Paper
Pencil

PERFORMANCE GUIDE:

1. Read blueprint and any notes or bill of materials that may be attached.
2. Note the appropriate tools and materials for the job.
3. Plan all details of the job to specifications.

DUTY: READ AND INTERPRET BLUEPRINTS

PERFORMANCE OBJECTIVE NO. 160

TASK: Interpret geometric blueprints

STANDARD: Blueprint specifications must be read to produce accurate dimensions.

SOURCE FOR STANDARD: Writing team of incumbent workers.

CONDITIONS FOR PERFORMANCE OF TASK:

Blueprints
Paper
Pencil

PERFORMANCE GUIDE:

1. Read blueprints and any notes or bill of materials that may be attached.
2. Note the appropriate tools and materials needed for the job.
3. Plan all details of the job to specifications.

DUTY: READ AND INTERPRET BLUEPRINTS

PERFORMANCE OBJECTIVE NO. 161

TASK: Read information blocks on blueprint

STANDARD: Information must be clearly understood and applicable to the print.

SOURCE FOR STANDARD: Writing team of blueprint workers

CONDITIONS FOR PERFORMANCE OF TASK:

Blueprint
Paper
Pencil

PERFORMANCE GUIDE:

1. Read each section of the information blocks (names of the part, specified tolerance, etc.).
2. Note the plan for the job including tools and materials needed.
3. Read bill of material.

DUTY: PERFORMING MATHEMATICAL CALCULATIONS

PERFORMANCE OBJECTIVE NO. 162

TASK: Convert fractions and metrics to decimals

STANDARD: Fractions and metric must be converted to decimal dimension to an accuracy of plus or minus .001".

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Paper

Pencil

Calculator

List of fractions and metrics

Machinist's handbook with tables and charts for conversion

PERFORMANCE GUIDE:

1. Note fraction or metric measurement.
2. Divide numerator of fraction by the denominator.
3. Round answer off to nearest .001".
4. Verify answer with decimal equivalent chart from machinist's handbook or other related conversion charts.

DUTY: PERFORMING MATHEMATICAL CALCULATIONS

PERFORMANCE OBJECTIVE NO. 163

TASK: Convert decimals to drill sizes

STANDARD: Drill size must be to the nearest calculation.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Paper
Pencil
Machinist's handbook
Decimals for dimensions of drill

PERFORMANCE GUIDE:

1. Check letter, number and fraction charts for decimal equivalents.
2. Select drill nearest to calculations.
3. Record answers.

DUTY: USING WORK HOLDING DEVICES

PERFORMANCE OBJECTIVE NO. 164

TASK: Turn parts using center drivers

STANDARD: Part must be firmly seated between centers.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Centers (ballbearing and spindle nose center)
Drive plate
Lathe
Lathe dog
Center drilled workpiece

PERFORMANCE GUIDE:

1. Mount drive plate and attach to spindle.
2. Attach lathe dog to workpiece.
3. Use bent tail of lathe dog for driving cylindrical pieces.
4. Use clamp dog for work with flat sides.
5. Use hardened drive centers to machine entire length of work mounted between centers without lathe dog interference.
Heavy and light lathe cuts can be made.

DUTY: USING WORK HOLDING DEVICES

PERFORMANCE OBJECTIVE NO. 165**TASK:** Install workpiece in 3-jaw chuck**STANDARD:** Workpiece must be installed while observing all safety procedures. Workpiece must be aligned to a tolerance of $\pm .008"$.**SOURCE FOR STANDARD:** Writing team of incumbent workers**CONDITIONS FOR PERFORMANCE OF TASK:**

Chalk
Lathe
Wrenches
Workpiece
3-jaw chuck and key (universal)

PERFORMANCE GUIDE:

1. Open chuck jaws.
2. Insert workpiece between jaws:
 - a. extension of workpiece must be held to a minimum.
 - b. hold workpiece to prevent workpiece from slipping between two jaws.
3. Insert chuck wrench and tighten jaws while holding workpiece.

DUTY: USING WORK HOLDING DEVICES

PERFORMANCE OBJECTIVE NO. 166

TASK: Install workpiece in 4-jaw chuck

STANDARD: Workpiece must be installed while observing all safety procedures. Workpiece must be aligned to a tolerance of $\pm .001$ ".

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Lathe
Chalk
Dial indicator
Wrenches
4-jaw chuck and key (independent chuck)

PERFORMANCE GUIDE.

1. Mount workpiece in 4-jaw chuck using rings on face of chuck to align.
2. Center workpiece with chalk using one jaw for each adjustment
 - a. mount toolholder in tool post
 - b. rest chalk on toolholder
 - c. rotate workpiece holding chalk against tool holder
 - d. dial in
3. Mount indicator on tool post.
4. Check each jaw with indicator against workpiece until all jaw are tightened to tolerance.

DUTY: USING WORK HOLDING DEVICES

PERFORMANCE OBJECTIVE NO. 167

TASK: Hold parts using air chucks

STANDARD: Part must be centered to an accuracy of .001" to .005".

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Appropriate air chuck for lathe or chucker
Workpiece compatible to chuck dimensions or capacity

PERFORMANCE GUIDE:

1. Clean chuck to insure accuracy.
2. Install chuck into tapered or threaded spindle hole.
3. Test opening and closing of chuck.
4. Insert workpiece and close chuck jaws.

DUTY: USING WORK HOLDING DEVICES

PERFORMANCE OBJECTIVE NO. 168

TASK: Machine parts using collet chucks

STANDARD: Parts must be centered to an accuracy of .0005" to .001".

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Appropriate collet chuck
Lathe
Workpiece of standard dimensions
Tool holder
Tool bit
Micrometer

PERFORMANCE GUIDE:

1. Clean collet to insure accuracy.
2. Install collet attachment into lathe spindle hole.
3. Thread the collet into the taper.
4. Insert workpiece and tighten collet jaws.
5. Select speed and feed of machine.
6. Place tool holder and tool bit in tool post holder.
7. Center tool bit on center line of machine.
8. Turn machine on and turn to size.

DUTY: USING WORK HOLDING DEVICES

PERFORMANCE OBJECTIVE NO. 169

TASK: Install workpiece on faceplate

STANDARD: Workpiece must be centered and balanced.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Faceplate
Lathe
Workpiece

PERFORMANCE GUIDE:

1. Place the faceplate on the benchface up.
2. Set the workpiece on the plate.
3. Arrange the bolts, washers, and nuts in the slots for suitable clamping.
4. Center the workpiece and tighten the clamping nuts just enough to hold the workpiece in place.
5. Mount the faceplate on the spindle.
6. True up the workpiece and tighten all clamping nuts.
7. Arrange and clamp the counterweights to balance the workpiece if necessary.

DUTY: USING WORK HOLDING DEVICES.

PERFORMANCE OBJECTIVE NO. 170**TASK:** Machine parts with magnetic chucks**STANDARD:** Parts must be held square and securely.**SOURCE FOR STANDARD:** Writing team of incumbent workers**CONDITIONS FOR PERFORMANCE OF TASK:**Lathe
Magnetic chucksTool holder
Tool bit**PERFORMANCE GUIDE:**

1. Install magnetic chucks to lathe.
2. Magnetize the chuck by inserting the key and turning it 180 degrees or to the desired amount of magnetism.
3. Attach workpiece to chuck and adjust or true to desired position.
4. Adjust magnetism further if necessary.
5. Select speed and feed.
6. Mount tool holder and tool bit into tool post on center line of machine.
7. Perform machining operations.

DUTY: PERFORMING PRODUCTION OPERATIONS

PERFORMANCE OBJECTIVE NO. 171

TASK: Adjust coolant system

STANDARD: Coolant must have sufficient capabilities to dissipate heat generated.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

PERFORMANCE GUIDE:

1. Regulate pump flow from reservoir.
 2. Adjust supply nozzle to thoroughly cover material.
 3. Coolant must be returned to tank quickly to relieve heating (no restrictions to flow).
-

DUTY: PERFORMING PRODUCTION OPERATIONS

PERFORMANCE OBJECTIVE NO. 172

TASK: Drill holes with Jacobs chuck

STANDARD: Holes must be concentric to outside dimension of part.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Job specifications
Lathe with drill and accessories
Workpiece
3-jaw chuck and key
Drill bits
Center drill
Jacobs chuck and key

PERFORMANCE GUIDE:

1. Set up Jacobs chuck in tailstock spindle or in drill holder supported by the dead center.
2. Check alignment of tailstock with the lathe center line.
3. Mount workpiece in 3-jaw chuck and tighten on spindle.
4. Select speed for basic drill bit size.
5. Place center drill in Jacobs chuck and drill to required depth.
6. Place regular drill bit into Jacobs chuck and drill to required depth.
7. Inspect part.

DUTY: PERFORMING PRODUCTION OPERATIONS

PERFORMANCE OBJECTIVE NO. 173

TASK: Thread parts using taps

STANDARD: Threaded part must meet class 2A fit.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Cutting oil
Job specifications
Taps (machine spiral)
Tap wrench
Lathe

PERFORMANCE GUIDE

With machine power off:

1. Determine correct tap drill size from tap drill chart according to job specifications.
2. Install tap in drill chuck in tailstock.
3. Clamp the tailstock to the ways and keep the dead center in the center of the tap by slowly turning the tailstock handwheel.
4. Apply cutting oil and slide the tailstock so the tap engages the work.
5. Turn tap with tap wrench with spindle engaged in low gear or disengage the spindle and turn the chuck by hand while the tap wrench handle rests on the compound.

DUTY: PERFORMING PRODUCTION OPERATIONS

PERFORMANCE OBJECTIVE NO. 174

TASK: Thread parts using dies

STANDARD: Threads must meet class 2B fit.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Job specifications
Lathe and accessories
Workpiece.
Die stock
Die

PERFORMANCE GUIDE:

1. Adjust the toolholder in the tool post so that it is parallel to the center line.
2. Set the toolholder to the extreme right of the compound slide T slot.
3. Back out the crossfeed as far as possible.
4. Let the handle of the die stock rest on the toolholder.
5. Install workpiece, setting the tailstock as close as possible, and clamp it to the bed.
6. Using a slow spindle speed, feed the tailstock spindle against the die with your right hand as you control the lathe spindle speed switch with your left hand.

DUTY: PERFORMING PRODUCTION OPERATIONS

PERFORMANCE OBJECTIVE NO.175

TASK: Face parts

STANDARD: Faced piece part must be flat within $\pm .0005$ " and relatively free from tool marks.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Job specification
Lathe and accessories
Measurement instruments
Workpiece
Tool holder and facing bit
3-jaw chuck

PERFORMANCE GUIDE:

1. Install workpiece in chuck (as per job specification) less than 5 diameters from the chuck jaws.
2. Select tool and set to the tailstock center point so tool point is set to center of work.
3. Attach tool holder and facing bit to tool post. Place on center line.
4. Make a trial cut to the center of work.
5. Lock carriage and set speed and feed rates according to ratio listed on index plate of the quick-change gear box.
6. Adjust compound and measure trial cut when facing to length.
7. Perform cutting operation by using cross feed handle.

DUTY: PERFORMING PRODUCTION OPERATIONS

PERFORMANCE OBJECTIVE NO. 176

TASK: Turn stock to precision length

STANDARD: Part must be to length to within $\pm .010$ of blueprint specifications.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Job specifications
Lathe
Micrometer carriage stop
Workpiece

Tool holder
Lathe bit
Wrenches
3-jaw chuck and key

PERFORMANCE GUIDE:

1. Mount 3-jaw chuck with workpiece.
2. Attach micrometer carriage stop to the ways of the lathe.
3. Install cutting tool and workpiece according to job specifications.
4. Select feeds on sliding gear shift levers of quick-change gear box (cross-feed or longitudinal).
5. Determine hand feed or power feed needs.
6. When approaching shoulder or chuck jaws while machining, disengage the power feed and hand feed the carriage for the last $1/8$ inch.
7. Inspect and measure length.

DUTY: PERFORMING PRODUCTION OPERATIONS

PERFORMANCE OBJECTIVE NO. 177**TASK:** Adjust stops**STANDARD:** Micrometer carriage stop must be firmly seated on machine ways.**SOURCE FOR STANDARD:** Writing team of incumbent workers**CONDITIONS FOR PERFORMANCE OF TASK:**

Job specifications
Lathe and accessories
Micrometer carriage stop

PERFORMANCE GUIDE:

1. Attach micrometer carriage stop to the ways of the lathe according to job specifications.
2. Adjust stops after each carriage movement.
 - a. carriage stop is to be adjusted to boss on carriage
 - b. ~~do not force the carriage and carriage stop abruptly~~
together--use a light feel

DUTY: PERFORMING PRODUCTION OPERATIONS

PERFORMANCE OBJECTIVE NO.178

TASK: Adjust micrometer collars.

STANDARD: Micrometer collars must have no backlash.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Job specifications
Lathe and accessories

PERFORMANCE GUIDE:

1. Adjust micrometer set screw as necessary after each pass to insure accuracy.
2. Check graduation of micrometer collars to determine if single or double depth readings of lead screw.
3. Place tool bit against material to be machined and adjust to zero.
4. Determine which type of graduation you are using by setting a fractional amount on the dial and measure on the cross slide with a rule.
5. Set dial according to job specifications.

DUTY: PERFORMING PRODUCTION OPERATIONS

PERFORMANCE OBJECTIVE NO. 179

TASK: Turn tapers

STANDARD: Taper must be in tolerance to fit a number 3 Morse taper.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Dial indicators
 Job specifications
 Workpiece
 Centers
 Lathe and accessories
 Machinist's handbook
 Turning tool holder and bit
 Micrometer

PERFORMANCE GUIDE:

Offset tailstock

1. Attach turning tool to toolpost.
2. Loosen clamping nut on tailstock.
3. Install workpiece between centers.
4. Adjust screws to desired degree or taper per inch.
 - a. formula:

$$\text{Offset} = \frac{TL}{2}$$
 where T = taper per inch
 L = entire length of work in inches
5. Place dial indicator on quill and move to desired offset of tailstock.
6. Cut taper.

DUTY: PERFORMING PRODUCTION OPERATIONS

PERFORMANCE OBJECTIVE NO.180

TASK: Machine a radius

STANDARD: Radius must be gaged to a tolerance of $\pm .001$ with a radius gage.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Lathe chuck and key
Lathe and accessories
Job specifications
Machinist's handbook

Lathe bit
Turning tool
Radius attachment
Workpiece
Radius gage

PERFORMANCE GUIDE:

1. Attach turning tool to toolholder.
2. Set radius attachment on compound.
 - a. end of vise tool must be on radius of workpiece
 - b. turn radius tool toward operator making several passes of cut
3. Set radius degree on compound according to job specifications.
4. Attach workpiece to appropriate work holding device.
5. Set turning tool to appropriate position on workpiece.
6. Lock carriage down and turn on machine.
7. Hand operate radius attachment.
8. Inspect radius with gage.

DUTY: PERFORMING PRODUCTION OPERATIONS

PERFORMANCE OBJECTIVE NO. 181

TASK: Center drill parts

STANDARD: Parts must be center drilled and not exceed its basic diameter.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Jacobs chuck
Job specifications
Lathe and accessories
Center drill #4 or #5

3-jaw chuck (universal)
Tool holder
Workpiece
Machinist's handbook

PERFORMANCE GUIDE:

1. Fit drill chuck to tailstock, aligned with lathe centerline.
2. Insert center drill in drill chuck.
3. Install faced workpiece in chuck.
4. Loosen nut on tailstock and slide tailstock to touch work.
5. Clamp tailstock and proceed to drill by hand with tailstock handwheel.
6. Inspect hole for correct depth.

DUTY: PERFORMING PRODUCTION OPERATIONS

PERFORMANCE OBJECTIVE NO. 182**TASK: Spotface****STANDARD: Spot drilling must be held securely and free of movement.****SOURCE FOR STANDARD: Writing team of incumbent workers****CONDITIONS FOR PERFORMANCE OF TASK:**

Job specifications
Lathe and accessories
Machinist's handbook
Jacobs chuck and key

Flatbottom drill
Tool holder
Workpiece

PERFORMANCE GUIDE:

1. Fit drill chuck to tailstock aligned with lathe centerline.
2. Insert flatbottom drill in drill chuck.
3. Install tool holder placed against the drill near the point.
4. Install workpiece.
5. Loosen nut on tailstock and slide tailstock to touch workpiece.
6. Clamp tailstock and proceed to drill by hand with tailstock handwheel.

DUTY: PERFORMING PRODUCTION OPERATIONS

PERFORMANCE OBJECTIVE NO.183

TASK: Install a steady rest

STANDARD: Steady rest must hold, steady, and/or position of work-piece while machining piece apart.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Chuck and key
Job specifications
Lathe and accessories
Lubricant (grease)

Mallet
Steady rest
Dial indicator

PERFORMANCE GUIDE:

1. Mount and center workpiece in a chuck.
2. Slide the steady rest to a convenient location on the shaft.
3. Tighten the steady rest to the bed of the ways.
4. Apply a high pressure lubricant to the shaft and the top half of fingers. Close and clamp the fingers lightly.
5. Place lathe in neutral.
6. Attach dial indicator and dial the workpiece in. Lightly tap the workpiece as the workpiece is revolved by hand.
7. Tighten firmly the three fingers. Do not bind fingers and workpiece with heavy pressure.
8. Machine workpiece.

DUTY: PERFORMING PRODUCTION OPERATIONS

PERFORMANCE OBJECTIVE NO. 184

TASK: Use a follower rest

STANDARD: Follower rest must hold, steady, and/or position workpiece while machine is running.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Job specifications
Lathe and accessories
Follower rest
Turning tool

Tool holder
Centers
Lathe dog
Grease

PERFORMANCE GUIDE:

1. Bolt the follower rest to the carriage at the saddle of the lathe.
2. Attach the turning tool and adjust the jaws of the follower rest.
3. Make a trial cut of two to three inches with the jaws backed off.
4. Adjust the lower jaw finger tight, then the upper jaw.
5. Tighten locking screws.
6. Grease the jaws and machine.

DUTY: PERFORMING PRODUCTION OPERATIONS

PERFORMANCE OBJECTIVE NO. 185

TASK: Recess a part

STANDARD: Under cut must not exceed a tolerance of $\pm .010$ for depth.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Cut off tool
Job specifications
Tool post
Workpiece
Work holding device
Chuck and key

PERFORMANCE GUIDE:

1. Mount chuck on lathe.
2. Attach cut off tool to tool post.
3. Install work in proper work holding device (chuck).
4. Set speed of machine.
5. Move tool by hand into workpiece to cut required recess.
 - a. tool must be squared to workpiece
 - b. speed must be reduced to prevent breakage

DUTY: PERFORMING PRODUCTION OPERATIONS

PERFORMANCE OBJECTIVE NO. 186

TASK: Cut off parts

STANDARD: Parts must be squared with sides that have been parted.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Cut off tool with 45° angle
Job specifications
Work holding device
Workpiece

Lathe
Chuck and key

PERFORMANCE GUIDE:

1. Attach cut off tool to tool post holder.
2. Install workpiece in appropriate work holding device according to job specifications.
3. Lock carriage.
4. Feed point of cutting tool by hand or power feed.
 - a. tool must be on center
 - b. tool must be square to workpiece
5. Select speed (slow).
6. Part off.

DUTY: PERFORMING PRODUCTION OPERATIONS

PERFORMANCE OBJECTIVE NO. 187

TASK: Adjust manual feed levers

STANDARD: Feed levers must be engaged quickly and without binding.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Job specifications
Lathe and accessories

PERFORMANCE GUIDE:

1. The carriage apron contains the hand wheel for hand feeding.
2. The feed change lever diverts the feed to either the carriage or the cross feed screw on the saddle.
3. The handwheel on the tailstock is used for hand feeding.
4. Half nut lever is used for threading operations.
5. Selector lever is used for directing the carriage either right of left and neutral.

DUTY: PERFORMING PRODUCTION OPERATIONS

PERFORMANCE OBJECTIVE NO. 188

TASK: Adjust power feed

STANDARD: Power feed levers must mesh easily with the power train.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Lathe and accessories
Job specifications

PERFORMANCE GUIDE:

1. The sliding gear shifter levers on the quick change gear box are used to select feeds or threads per inch, or pitch.
2. The carriage apron power feed lever engages a clutch to a gear drive train in the apron.
3. The reverse feed lever is set after determining the ratio on the quick change gear box index plate.
4. Feed rod lever is used to feed carriage.

DUTY: CHANGING LATHE TOOLS

PERFORMANCE OBJECTIVE NO. 189

TASK: Inspect lathe tools

STANDARD: Tools must be secure for setup and safety of operators.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Chuck keys
Face plates
Tool blueprint
Manufacturer's manual

PERFORMANCE GUIDE:

1. Inspect the condition of the tool holder and tool bit.
2. Inspect tools, chuck keys, and face plates.
3. Check 3-jaw and 4-jaw chuck for runout.
4. Inspect 60° centers for concentricity.

DUTY: CHANGING LATHE TOOLS

PERFORMANCE OBJECTIVE NO. 190

TASK: Remove and replace tools

STANDARD: Replaced tools must operate efficiently.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Cutting bit
 Chuck block
 Jacobs chuck and key
 Steel rod
 Drills
 Tool post holder

PERFORMANCE GUIDE:

Work holding tools

1. Remove tool holder by loosening bolt on tool post holder.
2. Remove chuck by locking spindle and placing steel rod between jaws of chuck. Break thread and remove chuck.
3. Remove cam lock chuck by positioning all locking cam to off position. Grasp and slide chuck off of spindle nose.
4. Remove drive plate, face plate by positioning side hook tool into slots and turn until threads are broken.
5. Remove line centers by inserting knock out bar into spindle by sliding bar with a hitting action.
6. Replace chuck on threaded spindle by holding and turning until seated.
7. Replace cam lock chuck by inserting cam fingers into slots and turn with locking key.

Cutting tools

1. Remove tool bit by loosening bolt on tool holder.
2. Remove drill chuck with drill bit by inserting chuck key in chuck and loosen.
3. Remove taper drills and reamers by turning tailstock handwheel until quill is completely returned inside of tailstock.
4. Remove boring bars by loosening bolt on tool holder.

DUTY: CHANGING LATHE TOOLS

PERFORMANCE OBJECTIVE NO. 191

TASK: Position tool location

STANDARD: Tool bit must be adjusted on center of machine.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Lathe and accessories
Job specifications
Tool holder
Tools

PERFORMANCE GUIDE:

1. Adjust tools on tool holder according to job specifications.
2. Adjust tool bit to the live or dead center of lathe.
3. Position tool holder to have 30° to 45° lead angle away from face plate.

DUTY: CHANGING LATHE TOOLS

PERFORMANCE OBJECTIVE NO. 192**TASK:** Sharpen turning tools**STANDARD:** Cutting tools must be sharpened according to the cutting material variables.**SOURCE FOR STANDARD:** Writing team of incumbent workers**CONDITIONS FOR PERFORMANCE OF TASK:**

Job specifications
Pedestal grinder
Aluminum oxide stones
Tool gages

Tool angles (chart)
Machinery handbook
Tool engineer's handbook

PERFORMANCE GUIDE:

1. Hand sharpen 5/16 or 3/8 cutting tool blanks on pedestal grinder.
 - a. tool angles must be held to $\pm 1^\circ$.
 - b. side clearance, back rake, side rake and nose clearance vary with cutting material--see handbooks
2. Sharpen boring bars by hand.
 - a. use tool gage for checking accuracy of angles
 - b. tool angles are held to the cutting material variables
3. Sharpen cut off and form tools by hand.

DUTY: CHANGING LATHE TOOLS

PERFORMANCE OBJECTIVE NO. 193

TASK: Change carbide inserts

STANDARD: Inserts must be replaced when dulled design.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Welding torch equipment
Tool holder with carbide insert
Silver solder and equipment

PERFORMANCE GUIDE:

1. Heat the carbide insert to melt silver solder.
2. Remove insert and clean.
3. Replace insert.
4. Re-silver solder.

DUTY: INSPECTING PARTS

PERFORMANCE OBJECTIVE NO. 194

TASK: Calibrate micrometers

STANDARD: Micrometers must be calibrated to $\pm .0001$.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Johnson block (gage block)
Micrometer
Micrometer spanner wrench

PERFORMANCE GUIDE:

1. With the standard on the micrometer, take a reading, loosen barrel and make adjustments. Tighten barrel.
2. With a gage block, check micrometer and take a reading for accuracy. Loosen barrel on micrometer and make adjustment. Tighten barrel.
 - a. attention must be paid to overtightening of the adjustment
 - b. apply light pressure between gage block and micrometer when zeroing in to the reading

DUTY: INSPECTING PARTS

PERFORMANCE OBJECTIVE NO. 195

TASK: Measure with micrometers

STANDARD: Workpiece must be measured with micrometer to within
 $\pm .0005$ " of job specifications.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Part
Micrometer

PERFORMANCE GUIDE:

1. Hold test part in your hand.
2. With other hand, place the ring finger and small finger through the frame and use your thumb and two other fingers to adjust for the "feel" of the micrometer.
3. Measure with a light but snug pressure, placing the part between the anvil and the spindle of the micrometer.
4. Take several readings and record.

DUTY: INSPECTING PARTS

PERFORMANCE OBJECTIVE NO. 196

TASK: Measure with dial calipers

STANDARD: Workpiece must be measured with calipers to within
± .0005" of job specifications.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Job specifications
Inside calipers (dial)
Outside calipers (dial)
Workpiece

PERFORMANCE GUIDE:

1. Select inside or outside calipers according to job specifications.
2. Make adjustment of calipers to touch on part.
3. Read the dial to the nearest tenth.
4. Take another reading and record the average.

DUTY: INSPECTING PARTS

PERFORMANCE OBJECTIVE NO. 197

TASK: Measure with fixed gages

STANDARD: Workpiece must be measured to within ± 0.001 of job specifications.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Job specifications
Workpiece
Plug gage
Snap gage

PERFORMANCE GUIDE:

1. Clean workpiece.
2. Check workpiece with gages.
 - a. insert go gage on workpiece
 - b. insert no gage on workpiece
3. Record correct or incorrect workpiece size.

DUTY: INSPECTING PARTS

PERFORMANCE OBJECTIVE NO. 198

TASK: Measure with rule

STANDARD: Workpiece must be measured with rule to within $\pm 1/64"$ of job specifications.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Rule
Job specifications
Workpiece

PERFORMANCE GUIDE:

1. Select rule.
2. Turn rule (scale) in its edge with the part to be measured.
3. Transfer the measurement from the workpiece to the edge of the scale.
4. Record answer.

DUTY: INSPECTING PARTS

PERFORMANCE OBJECTIVE NO. 199

TASK: Measure out of around workpiece using dial indicators

STANDARD: Workpiece must be measured to within $\pm .0005$ " of job specifications.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Job specifications
Lathe and accessories
Chuck and key (independent)
Dial indicator
Workpiece

PERFORMANCE GUIDE:

1. Select dial indicator and base.
2. Place workpiece in chuck and snugly tighten each jaw using chuck face rings as a guide.
3. Turn chuck by hand and "eyeball" the piece to the center of machine.
4. Attach indicator to tool post.
5. Bring the indicator plunger to the workpiece surface and turn the chuck by hand.
6. Move each jaw of the chuck until the pointer on the indicator is stationary to within $\pm .0005$.
7. Caution note: Do not "peg" indicator.
8. Retighten each jaw.
9. Recheck workpiece again.

DUTY: INSPECTING PARTS

PERFORMANCE OBJECTIVE NO. 200

TASK: Measure diameter and taper with bore gages

STANDARD: Workpiece must be measured to the accuracy of gages.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Job specifications

Chalk

Tapers

Taper gage

Ring gage

PERFORMANCE GUIDE:

Internal Taper

1. Make a chalk mark along the length of the taper plug gage.
2. Insert the gage into the internal taper and turn slightly.
3. Take out the gage and check where the chalk mark has been partially wiped off where contact was made.
4. Make adjustments until the chalk mark is rubbed off along its full length.

External Taper

1. The external taper is marked with chalk before being checked with a taper ring gage.
2. The ring gage is placed on the taper snugly and is rotated slightly.
3. The ring gage is removed and the chalk mark is rubbed off evenly for the entire length of the ring.

Note: Prussian blue can be substituted for the chalk.

DUTY: INSPECTING PARTS

PERFORMANCE OBJECTIVE NO. 201

TASK: Measure with an optical comparator

STANDARD: Workpiece must be within print tolerance of master test piece.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Dust cloth
Optical comparator
Job specifications
Master specimen (template)
Screw with thread

PERFORMANCE GUIDE:

Adjusting

1. Mount centers.
2. Mount lens in optical comparator.
3. Place master on screen.
4. Turn on optical comparator.
5. Mount workpiece.
6. Compare workpiece to master.
7. Check dimensions of workpiece to job specifications.

DUTY: INSPECTING PARTS

PERFORMANCE OBJECTIVE NO. 202

TASK: Measure inside diameters using telescoping gage

STANDARD: Workpiece must be measured to within $\pm .0005$ " of job specifications.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Telescoping gage
Bore specimen
Outside micrometer
Job specifications

PERFORMANCE GUIDE:

1. Select the proper telescope gage for the desired measurement.
2. Insert the gage into the bore and release the handle lock screw. Rock the gage sideways to insure measurement of the full diameter.
3. Lightly tighten the locking screw in the gage.
4. Use a downward or upward motion and roll the gage through the bore. The plungers will be pushed in conforming to the bore diameter. Tighten the locking screw firmly and roll the gage back through the bore. Feel for a light drag.
5. Remove the gage and measure with an outside micrometer.
6. Place the gage between the micrometer spindle and anvil. Try to determine the same feel on the gage with the micrometer as you felt while the gage was in the bore.
7. Take at least two readings in order to verify reliability.

DUTY: INSPECTING PARTS

PERFORMANCE OBJECTIVE NO. 203

TASK: Measure with radius gage

STANDARD: Workpiece must fit gage so no light shows between gage and workpiece.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Job specifications
Radius gage
Workpiece

PERFORMANCE GUIDE:

1. Place radius gage on centerline of workpiece.
2. Check for light between gage and workpiece.
3. Accept or reject workpiece.

DUTY: INSPECTING PARTS

PERFORMANCE OBJECTIVE NO. 204

TASK: Inspect threads

STANDARD: Threads must meet a class 2A fit.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Threaded workpiece
Thread pitch gage
Mating part
Job specifications
Thread pitch micrometer

PERFORMANCE GUIDE:

1. Check fit of threads with mating part (gage).
2. Use a thread gage to compare reading with job specifications.
3. Micrometer thread to check for pitch diameter.
4. Record measurement.

DUTY: MAINTAINING WORK AREA

PERFORMANCE OBJECTIVE NO. 205

TASK: Change coolant

STANDARD: Coolant must be changes with reservoir filled to desired level with clean collant.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Coolant
Scrapers
Shop towels

PERFORMANCE GUIDE:

1. Pump, dip, or siphon coolant from the reservoir tank.
2. Clean all wire and baffles, plates from sludge build up in reservoir.
 - a. use a flat tool to break particles inbeded against reservoir bottom.
 - b. scrape sides from all build up of algae, rust, foreign material and oil sludge.
3. Use the hand scraperwith a towel to remove heavy loose build up of material.
4. Vacuum entire reservoir.
5. Add new oil with proper ratio into reservoir.

DUTY: USING WORK HOLDING DEVICES

PERFORMANCE OBJECTIVE NO. 206

TASK: Install workpiece on magnetic parallels

STANDARD: Workpiece must be installed according to steps in performance guide.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Magnetic chuck
Grinding machine
Laminated parallels
Workpiece

PERFORMANCE GUIDE:

1. Place workpiece on magnetic chuck.
 - a. workpiece must be squared with chuck
 - b. surface lay must be correct to specifications
2. Support the workpiece with laminated parallels.
3. Set the magnetic force.

DUTY: USING WORK HOLDING DEVICES

PERFORMANCE OBJECTIVE NO. 207

TASK: Install workpiece on vacuum chuck

STANDARD: Vacuum must hold workpiece while machining.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Grinder
Vacuum chuck
Workpiece

PERFORMANCE GUIDE:

1. Place workpiece on vacuum chuck of grinding machine.
2. Evacuate the air under the workpiece.

DUTY: SETTING UP SURFACE GRINDERS

PERFORMANCE OBJECTIVE NO. 208

TASK: Select work holding device

STANDARD: Appropriate work holding device must be selected in accordance to the job to be performed.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Angle plate
Job specifications
Grinding vise
Magnetic chuck
Sine bar
V-block
Workpiece

PERFORMANCE GUIDE:

1. Select work holding device.
 - a. work can be clamped directly to the table or in a vise fastened to the table
 - b. work may be held on a magnetic chuck in conjunction with a V-block, angle plate, or sine bar vise
2. Square work to holding device.

DUTY: SETTING UP SURFACE GRINDERS

PERFORMANCE OBJECTIVE NO. 209

TASK: Select grinding wheels

STANDARD: Appropriate grinding wheel must be selected in accordance to the job to be performed.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Job specifications
Selection of grinding wheels

PERFORMANCE GUIDE:

1. Select among the list of grinding wheels according to job specifications.

Material	Grain Size	Grade	Type of Abrasive	Bonding Process
Aluminum	30-46	H or I	C	Vitrified
Bronze	36 or 46	H	C	"
Cast Iron	30 or 46	I or J	C	"
Copper	30 or 36	H or I	C	"
High-speed Steel	46	G or H	A	"
Mild steel	36 or 46	I, J or K	A	"
Monel metal	46	G	A	"
Nitralloy (before nitriding)	36 or 36	J		"
Nitralloy (after nitriding)	60 to 100	H	A or C	"
Stainless Steel (soft)	36	H	C	"
Tool steel	36 or 46	H	A	"
Tungsten carbide (roughing)	60 or 80	G or H	C	"
Tungsten carbide (finishing)	80 or 100	F or G	C	"

DUTY: SETTING UP SURFACE GRINDERS

PERFORMANCE OBJECTIVE NO. 210

TASK: Mount grinding wheels

STANDARD: Grinding wheel must be securely mounted for desired performance.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Grinding wheel
Job specifications
Surface grinder

PERFORMANCE GUIDE:

1. Sound the wheel for cracks. Hold the wheel by the bore and tap it with a nonmetallic object. If the wheel is cracked it will give a dull thud.
2. Check to be sure the wheel has blotting paper washers on both sides around the hole.
3. Inspect the wheel flanges to make sure they are safety flanges and of proper size.
4. Place the wheel on the spindle.
5. Place the safety flange on the spindle.
6. Place the spindle nut on securely.
7. Tighten wheel guards in place.
8. Turn the wheel over by hand to make sure that it clears the housing.

DUTY: SETTING UP SURFACE GRINDERS

PERFORMANCE OBJECTIVE NO. 211

TASK: Set trip dogs on grinder table

STANDARD: Trip dogs must be firmly seated to prevent overtravel.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Job specifications
Surface grinder
Workpiece

PERFORMANCE GUIDE:

1. Set depth of cut on surface grinder.
2. Set trip dogs on table so that work travels 1/2" to 3/4" beyond work.
3. Set second trip dog to recycle work table at beginning of cycle.

DUTY: SETTING UP SURFACE GRINDERS

PERFORMANCE OBJECTIVE NO. 212

TASK: Dress wheel to angles

STANDARD: Wheel angle must be dressed to the angle specified in job specifications.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Cutting fluid
Surface grinder
Job specifications
Dressing tool
Grinding wheel

PERFORMANCE GUIDE:

1. True wheel.
2. Attach adjustable dresser and set at angle specified in job specifications and lock in place.
3. Dress wheel to angle by placing the point of the dresser in contact with the face of the wheel. Move at a rate of speed that will produce the desired form or surface on the cutting edge.
4. Apply cutting fluid as necessary to keep wheel from overheating.

DUTY: SETTING UP SURFACE GRINDERS

PERFORMANCE OBJECTIVE NO. 213

TASK: Dress wheel to a radius

STANDARD: Wheel must be dressed to within $\pm .015$ radius of job specifications.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Dressing tool
Grinding wheel
Job specification
Cutting fluid
Surface grinder

PERFORMANCE GUIDE:

1. True wheel.
2. Attach adjustable dresser and set radius dresser at radius specified in job specifications.
3. Dress wheel to radius by placing the point of the dresser in contact with the face of the wheel. Move at a rate of speed that will produce the desired form or surface on the cutting edge.
4. Apply fluid as necessary to keep work from overheating.

DUTY: SETTING UP INTERNAL GRINDER

PERFORMANCE OBJECTIVE NO. 214

TASK: Set feed depth using wheelhead stops

STANDARD: Feed depth must be set using wheelhead stops to within $\pm .001$ " of job specifications.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Job specifications
Internal grinder with wheelhead stops

PERFORMANCE GUIDE:

1. Set feed depth on table of internal grinder according to job specifications.
2. Set wheelhead stops on sides of grinder and tighten.
3. Dry run grinded to check for accuracy.

DUTY: SETTING UP INTERNAL GRINDER

PERFORMANCE OBJECTIVE NO. 215

TASK: Set feed depth using workhead stops

STANDARD: Feed depth must be set using workhead stops according to job specifications.

SOURCE FOR STANDARD: . Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Internal grinder with workhead stops
Job specifications

PERFORMANCE GUIDE:

1. Set feed depth on table of internal grinder according to job specifications.
2. Set workhead stops to dimensions in job specifications.
3. Dry run grinder to check for accuracy.

DUTY: SETTING UP EXTERNAL GRINDER

PERFORMANCE OBJECTIVE NO. 216

TASK: Adjust workpiece with traverse reversing dogs

STANDARD: Workpiece end must overlap basic tolerance size.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

External grinder
Job specifications
Workpiece

PERFORMANCE GUIDE:

1. Loosen table dogs on grinder.
2. Move and adjust reversing dogs to proper position.
3. Tighten reversing dogs.
4. Dry run grinder for accurate position of reversing dogs.

DUTY: SETTING UP EXTERNAL GRINDER

PERFORMANCE OBJECTIVE NO. 217

TASK: Adjust workpiece with wheelhead stops

STANDARD: Workpiece must be adjusted with wheelhead stops to within $\pm .005$ " of job specifications.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

External grinder
Job specifications

PERFORMANCE GUIDE:

1. Loosen wheelhead stops on sides of grinder.
2. Adjust workpiece to proper placement of length.
3. Set wheelhead stops and tighten.
4. Dry run grinder.

DUTY: SETTING UP EXTERNAL GRINDER

PERFORMANCE OBJECTIVE NO. 218

TASK: Set rapid travel

STANDARD: Rapid travel table must be free to move for recycled position.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

External grinder
Job specifications
Workpiece

PERFORMANCE GUIDE:

1. Set rapid travel dogs on external grinder to desired distance.
2. Engage clutch to clear workpiece.
3. Position rapid lever "on" to recycle.

DUTY: SETTING UP EXTERNAL GRINDER

PERFORMANCE OBJECTIVE NO. 219

TASK: Set cross feed automatically

STANDARD: Feed travel must be set to within 0.001" of job specifications.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

External grinder
Job specifications

PERFORMANCE GUIDE:

1. Start grinding wheel, coolant system and spindle.
2. Engage table traverse.
3. Feed grinding wheel in to work until spark out.
4. Move cross slide handwheel to advance the wheel to depth of the first rough cut.
5. Stop work rotation and measure workpiece.
6. Determine final depth of reading on handwheel.
7. Set cross feed positive stop mechanism to permit feeding to within 0.001.

DUTY: SETTING UP EXTERNAL GRINDER

PERFORMANCE OBJECTIVE NO. 220

TASK: Dress wheel to complex profile

STANDARD: Dress wheel must be set at angles specified in job specifications.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Lubricant
External grinder
Job specifications or blueprints
Dressing tool
Grinding wheel

PERFORMANCE GUIDE:

1. True wheel.
2. Attach adjustable dresser and set at angles specified in job specifications.
3. Dress wheel to angles by placing the point of the dresser in contact with the face of the wheel. Move at a rate of speed that will produce the desired profile.
4. Apply lubricant as necessary to keep work from overheating.
5. Compare wheel to blueprint or profile for accuracy or dimensions.

DUTY: OPERATING SURFACE GRINDERS

PERFORMANCE OBJECTIVE NO. 221

TASK: Operate surface grinder manually

STANDARD: Grinder must be capable to grind to a 64 microinch surface roughness.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Surface Grinder
Workpiece
Wrenches

PERFORMANCE GUIDE:

1. Select grinding wheel to suit the job and machine requirements.
2. Clean wheel spindle and grinding wheel bore.
3. Ring test wheel.
4. Mount wheel on spindle and replace wheel guards.
5. True/and dress wheel.
6. Wipe chuck face by rubbing palm of hand on face.
7. Clean Deburr and place workpiece near center of chuck & magnetize.
 - A. Overlap work piece on magnetic poles.
 - B. Position workpiece to provide square directional lay.
8. Start the spindle, coolant system and hydraulic pump, if wet grinding is done.
9. Allow a minute or more for "Run In Time."
10. Down feed grindwheel head until it touches (sparkout) the high spot.
11. Apply left hand to the cross feed wheel handle.
12. Apply right hand to the longitudinal handle feed wheel.
13. Run entire stroke of the longitudinal hand wheel to one end of work piece.
14. Advance in or out (depending upon starting direction) the cross feed hand wheel with an overlap of $\frac{1}{4}$ " to $\frac{1}{2}$ " of the grinding wheel face.
15. Repeat steps 13 and 14 until all the entire surface had been passed over.
16. Downfeed grinding wheel head (.001 - .002) off of the work-piece and repeat steps 10 through 14 until surface is ground down to desired finish.

DUTY: OPERATING SURFACE GRINDERS

PERFORMANCE OBJECTIVE NO. 222

TASK: Operate grinder using power feed

STANDARD: Grinding must be within $\pm .001$ " of tolerance and finish specified in job specifications.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Job specifications
Surface grinder (and attachments)
Workpiece

PERFORMANCE GUIDE:

1. Place workpiece on grinding chuck.
2. Set table length to workpiece (overlap 1/2" each end) by adjusting trip dog.
3. Set machine feed for overlapping work feed.
4. Bring grinding wheel into contact with .001-.002 depth of cut.
5. Engage automatic feed and machine.

DUTY: OPERATING SURFACE GRINDERS

PERFORMANCE OBJECTIVE NO. 223

TASK: Grind parts

STANDARD: Parts must be ground to $\pm .001$ of job specifications.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Blueprint
Micrometer
Surface grinder
Workpiece

PERFORMANCE GUIDE:

1. Micrometer part that has been finished from previous machining.
2. Decide which sides need grinding.
3. Grind that side taking measurement on the feed micrometer wheel.
4. Remove workpiece from chuck and measure.

DUTY: OPERATING SURFACE GRINDERS

PERFORMANCE OBJECTIVE NO. 224

TASK: Grind an angle

STANDARD: Angle must be within ± 15 seconds of job specifications.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Grinding wheel (formed)
Job specifications
Part
Surface grinder
Work holding devices

PERFORMANCE GUIDE:

1. Dress the angle on the grinding wheel.
2. Place part on magnetic chuck, sine bar, vise or other work holding device.
3. Touch wheel to part until it sparks.
4. Grind angle specified in job specifications.

DUTY: OPERATING SURFACE GRINDERS

PERFORMANCE OBJECTIVE NO. 225

TASK: Grind a radius on surface grinder

STANDARD: Radius must be within $\pm .010$ of gage.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Job specifications
Gage (radius)
Grinding wheel
Part
Surface grinder
Work holding devices

PERFORMANCE GUIDE:

1. Dress the radius on the grinding wheel.
2. Place part on magnetic chuck, sine bar vise, or other work holding device.
3. Touch wheel to part until it sparks.
4. Grind a radius specified in job specifications.

DUTY: OPERATING SURFACE GRINDERS

PERFORMANCE OBJECTIVE NO. 226

TASK: Grind to remove warp

STANDARD: Warp must be to within $\pm .010$ flat.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Flat plate
Thin pieces of paper
Surface grinder
Cutting fluid
Workpiece with warp

PERFORMANCE GUIDE:

1. Place workpiece on a flat plate after checking the warp.
2. Slide a piece of paper under the center of workpiece.
3. Magnetize then make a light cut.
4. Turn the workpiece over and place a piece of paper under each end.
5. Magnetize then make a light cut.
6. Apply fluid so work does not overheat.
7. Check workpiece for any signs of warp remaining.
8. If warp remains, repeat steps 1 through 7.

DUTY: OPERATING SURFACE GRINDERS

PERFORMANCE OBJECTIVE NO. 227

TASK: Grind to a square shoulder

STANDARD: Grinding must be 64 micro inches or greater.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Dresser
Job specifications
Mating part
Part with undercut shoulder
Surface grinder

PERFORMANCE GUIDE:

1. Square machined part on surface chuck with precision square.
2. Use #1 plane wheel and bring side of wheel to side of 90° shoulder with clearance.
3. Note cross feed micrometer setting and mark.
4. Back away and turn machine on, making very light cuts.
5. Advance only to the cross slide setting until part is thoroughly ground to desired finish.

DUTY: OPERATING SURFACE GRINDERS

PERFORMANCE OBJECTIVE NO. 228

TASK: Grind parallel surfaces

STANDARD: Surfaces must be ground to within $\pm .0005$ " of job specifications.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Job specifications
Magnetic chuck
Surface grinder
Workpiece with parallel surfaces

PERFORMANCE GUIDE:

1. Set up surface grinder.
2. Place workpiece with parallel surfaces in magnetic chuck and magnetize.
3. Grind first surface.
4. Clean and remove workpiece and turn over and place on magnetic chuck and magnetize.
5. Grind second surface.

DUTY: OPERATING SURFACE GRINDERS

PERFORMANCE OBJECTIVE NO. 229

TASK: Grind square surfaces

STANDARD: Surface must be squared to within $\pm .001$ of job specifications.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Angle plate	Parallels (precision)
Job specifications	Surface plate
Grinding wheel	"C" clamps
Surface grinder	
Workpiece with machined square surfaces	

PERFORMANCE GUIDE:

1. Set up surface grinder.
2. Place workpiece on angle plate at 90° from surface plate and tighten tightly.
3. Set to touch the end, then grind wheel according to job specifications.
4. Remove workpiece and turn to the opposite side. Place workpiece on angle plate and repeat steps 2 and 3.
5. Check workpiece for accuracy.

DUTY: OPERATING INTERNAL GRINDER

PERFORMANCE OBJECTIVE NO. 230

TASK: Grind Internal tapers

STANDARD: Grind must be within a 64
microinch surface roughness.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Grinder: workpiece
Holding Fixture
Wrenches

PERFORMANCE GUIDE:

1. Check the wheel head to be sure it is set at 0°.
2. Check that the swivel table is set at zero position.
3. Loosen the clamping bolts on the headstock base.
4. Swivel the head stock to the required angle. Secure head stock in position.
5. Determine spindle RPM required and set wheel speed.
6. Dress & true wheel.
7. Mount workpiece in a suitable chucking device on spindle.
8. Calculate workpiece speed (RPM) and determine the rate of table travel.
9. Desengage the power cross feed control lever.
10. Adjust table trip dogs.
11. Position wheel partly into the revolving workpiece and bring wheel into contact with the hole surface
12. Feed workpiece so that the grinding wheel grinds toward the back of the hole. (Note: steps 12 and 13 must be completed simultaneously).
13. Withdraw the workpiece to clear the wheel at the end of the cut.
14. Take repeated cuts until tapered hole is ground to its correct taper.

DUTY: OPERATING INTERNAL GRINDER

PERFORMANCE OBJECTIVE NO. 231

TASK: Grind an internal radius

STANDARD: Grind must meet 32 microinches of surface roughness.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Grinder
Workhead
Wrenches
Workpiece
Grinding spindle

PERFORMANCE GUIDE:

1. Mount workhead drive spindle to table.
2. Mount internal grinding spindle to internal cylindrical grinding head.
3. Mount and dress to desired radius with radius dresser.
4. Mount workpiece to workhead holder (chuck) and "dial in."
5. Bring grinding wheel into position for radius grinding.
6. Feed cross slide into position, and longitudinal travel to its position by placing wheel in hole.
7. Lock longitudinal travel nut.
8. Advance feed to the side wall gradually.
9. Spark out and examine for accuracy.
10. Proceed to grind until depth of radius is cut by the distance specified on the cross feed micrometer.

DUTY: OPERATING INTERNAL GRINDER

PERFORMANCE OBJECTIVE NO. 232

TASK: Grind an internal recess

STANDARD: Grinding must meet 32 microinches of surface roughness.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Grinder
Workhead
Wrenches
Workpiece
Grinding spindle

PERFORMANCE GUIDE:

1. Mount workhead drive spindle to table.
2. Mount internal grinding spindle to internal cylindrical grinding head.
3. Mount and dress grinding wheel to the width of the desired recess.
4. Mount workpiece to workhead holder (chuck) and "dial in."
5. Bring grinding wheel into position for undercutting.
6. Feed cross slide into position, and longitudinal travel to its position by placing wheel in hole.
7. Lock longitudinal travel nut.
8. Advance feed to the side wall gradually.
9. Spark out and examine for accuracy.
10. Proceed to grind until depth of recess is cut by the distance specified on the cross feed micrometer.

DUTY: OPERATING EXTERNAL GRINDER

PERFORMANCE OBJECTIVE NO. 233

TASK: Grind an external taper

STANDARD: Taper must fit taper gage to within $\pm .0005$ " of job specifications.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Grinder
Taper gage
Workpiece
Wrenches

PERFORMANCE GUIDE:

1. Release swivel table clamping bolts.
2. Swivel table to the required angle.
3. Tighten table clamping bolts to secure table.
4. Select grinding wheel. Mount balance, true, and dress the wheel.
5. Mount workpiece between centers.
6. Set headstock spindle RPM, rate of traverse, in feed rate, and dwell time.
7. Adjust flow rate of cutting fluid and secure splash trays.
8. Run machine approximately one minute to lubricate thoroughly.
9. Bring grinding wheel into position to take first cut.
10. Set wheelhead positive stop mechanism to automatic trip in feed at required position.
11. Take several roughing cuts until taper is developed.
12. Use taper gage and adjust table for any variation.
13. Set the feed rate on the fine feed dial for finish cut.
14. Spark out at the footstock and stop traverse and workpiece.
15. Remove and inspect workpiece.

DUTY: INSPECTING PARTS

PERFORMANCE OBJECTIVE NO. 234

TASK: Identify surface finishes

STANDARD: Surface finishes must be readily identified by the surface texture, surface finish and surface roughness.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Comparator specimens
Profilometer
Test piece

PERFORMANCE GUIDE:

Hand Comparison

1. Place test piece close to comparator and choose which surface is similar to each other.
2. Hand feeling and visual checking must be done in appropriate lighting conditions.

Machine

1. Place test piece on surface plate.
2. Set up profilometer.
 - a. set width cut off in machine
 - b. set lay direction
 - c. place stylus on test piece
 - d. set (RMS) or (AA) reading
 - e. turn tracer head on and record microinches

DUTY: CHANGING TOOLS

PERFORMANCE OBJECTIVE NO. 235

TASK: Remove tools

STANDARD: Circular tool must be checked for regrinding.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Tool post
Circular tool
Tools

PERFORMANCE GUIDE:

1. Loosen hook bolt.
2. Loosen center bolt through circular tool.
3. Remove tool.

DUTY: CHANGING TOOLS

PERFORMANCE OBJECTIVE NO. 236

TASK: Inspect tools

STANDARD: Tool must be checked, and if found to be dull, it is ground.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Circular tool
Eye lube

PERFORMANCE GUIDE:

1. Check for cratering holes on face of tool.
2. Check for tool edge wear.
3. Check tool number for hours of production run.
4. Determine if grinding is necessary.

DUTY: CHANGING TOOLS

PERFORMANCE OBJECTIVE NO. 237

TASK: Replace and adjust tools

STANDARD: Tool must produce an accurate part to within print tolerance

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Circular tool
Tool post
Wrenches
Locking bolts
Blueprint

PERFORMANCE GUIDE:

1. Replace tool in tool post with center bolt.
2. Rough adjust to center.
3. Tighten hook bolt.
4. Fine adjust to center.
5. Rough adjust slide to below size diameter.
6. Fine adjust to proper dimensional size, with fine tension screw adjustment.

DUTY: CHANGING TOOLS

PERFORMANCE OBJECTIVE NO. 238

TASK: Sharpen lathe tool

STANDARD: Tool must be sharp.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Tool 5/16 to 1/2 inch.
Surface grinder
Universal tool angle vise
Layout die
Protractor
Surface plate
Scribe

PERFORMANCE GUIDE:

1. Mount tool in vise on surface plate.
2. Measure the tool angle and coat with layout die.
3. Scribe angle with scribing tool.
4. Place vise on magnetic chuck and grind to the prescribed angle.
5. Repeat steps 1 through 4 for other angles if needed.

DUTY: CHANGING TOOLS

PERFORMANCE OBJECTIVE NO. 239

TASK: Adjust chasers to thread size

STANDARD: Thread must be adjusted to the basic size.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Adjustable self-opening die-head
One set of chasers
One set of ring gauges

PERFORMANCE GUIDE:

1. Using a sample part, screw the part into the diehead for rough sizing.
2. Adjust Allen screws on the diehead, to correct size for rough adjustment.
3. Line the diehead up using locking screws on the diehead shank plate.
4. Machine thread.
5. Readjust size with Allen screw setting to ring gauge size.

DUTY: CHANGING TOOLS

PERFORMANCE OBJECTIVE NO. 240

TASK: Sharpen drills

STANDARD: Drill must cut to its basic size.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Drill
Drill gage
Drill holder
Screw machine
Plug gage

PERFORMANCE GUIDE:

1. Check drill with drill gage for proper angle.
2. Set drill grinder and sharpen.
3. Recheck with drill gage.
4. Place in tool holder and machine part.
5. Check with plug gage for hole size.

DUTY: LOADING BAR STOCK

PERFORMANCE OBJECTIVE NO. 241

TASK: Deburr stock

STANDARD: Stock must slide easily into feed tube.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Pedestal grinder
12' bar

PERFORMANCE GUIDE:

1. Hold bar stock in hand and place edge of end on grinding wheel and rotate in a circular motion until all burrs are removed.
2. Check stock for any additional through-up burrs created by grinding wheel.

DUTY: LOADING BAR STOCK

PERFORMANCE OBJECTIVE NO. 242

TASK: Open chuck and install new bar

STANDARD: Bar must be centered with correct overhang.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Screw machine
12' bar

PERFORMANCE GUIDE:

1. Stop machine in proper position with chuck open.
2. Remove collar over feed tube on bearing.
3. Install the bar in the feed tube and through the collet with a pounding motion.
4. Replace collar over feed tube bearing.

DUTY: LOADING BAR STOCK

PERFORMANCE OBJECTIVE NO. 243

TASK: Index and position ram type turret

STANDARD: Bar end must be removed from previous bar.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Screw machine
Bar end stock

PERFORMANCE GUIDE:

1. Position turret to the extreme right end of carriage by hand wheel.
2. Automatic index of the turret will advance to next station.
3. Repeat step number one.

DUTY: LOADING BAR STOCK

PERFORMANCE OBJECTIVE NO. 244

TASK: Start machine and operate

STANDARD: Machine must run through complete cycle.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Screw machine

PERFORMANCE GUIDE:

1. Turn on main motor.
2. Engage clutch.
3. Machine spindle will turn.

DUTY: LOADING BAR STOCK

PERFORMANCE OBJECTIVE NO. 245

TASK: Inspect first part

STANDARD: Part must be free of tool marks, burrs, and meet blueprint specifications.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Micrometers
Blueprint
Inspection equipment

PERFORMANCE GUIDE:

1. Remove part from tray.
2. Inspect for tool marks and burrs.
3. Measure part according to specification sheet.
4. Readjust tooling if required.

DUTY: PERFORMING PRODUCTION OPERATIONS

PERFORMANCE OBJECTIVE NO. 246

TASK: Machine forms with circular tools

STANDARD: Parts must be manufactured within tolerance of $\pm .010$ " of blueprint specifications.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Circular form tool
Automatic screw machine
Circular tool posts
Wrenches

PERFORMANCE GUIDE

1. Set tool on center.
2. Adjust tool for rough cut.
3. Machine part and inspect.
4. Readjust for fine finish tool.
5. Inspect part for finish and size.

DUTY: PERFORMING PRODUCTION OPERATIONS

PERFORMANCE OBJECTIVE NO. 247

TASK: Turn diameters with roller box turning tool

STANDARD: Diameter must be machined within $\pm .005"$ of blueprint specifications.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Automatic screw machine
Roller box tool
Tools
Blueprint
Bars (stock)

PERFORMANCE GUIDE:

1. Set the box tool bit to rough diameter adjustment.
2. Set the rollers for find adjustment, putting no more than .002 pressure.
3. Check piece part for size and straightness.
4. Inspect according to blueprint specifications.

DUTY: PERFORMING PRODUCTION OPERATIONS

PERFORMANCE OBJECTIVE NO. 248

TASK: Feed bar stock to turret stop

STANDARD: Bar stock must be fully positioned for part length.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Turret stop
Complete job setup
Bar stock
Blueprint
Tools

PERFORMANCE GUIDE:

1. Open collet and position bar stock to stop.
2. Close collet and readjust if necessary.
3. Reposition turret for final-inspection.

DUTY: PERFORMING PRODUCTION OPERATIONS

PERFORMANCE OBJECTIVE NO. 249

TASK: Thread a part using an opening die holder

STANDARD: Piece part must be inspected for proper thread length and pitch diameter.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Adjustable diehead (collapsible)
Chasers
Complete job setup
Thread gages
Tools
Cutting oil

PERFORMANCE GUIDE:

1. Adjust thread blank to proper major diameter.
2. Line diehead up.
3. Select speed and feed.
4. Start machine and thread part with cutting oil.
5. Inspect pitch diameter.
6. Adjust pitch diameter, if necessary.
7. Reinspect.

DUTY: PERFORMING PRODUCTION OPERATIONS

PERFORMANCE OBJECTIVE NO. 250

TASK: Rough turn parts with a balance turning tool

STANDARD: Part must conform to blueprint rough diameter to within $\pm .010$ ".

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Balance turning tool
Blueprint
Inspection equipment
Complete job setup
Tools
Screw machine

PERFORMANCE GUIDE:

1. Feed bar stock out to proper length.
2. Adjust balance turning tool to proper size.
3. Run piece part.
4. Inspect diameter.
5. Readjust to proper size.

DUTY: PERFORMING PRODUCTION OPERATIONS

PERFORMANCE OBJECTIVE NO. 251

TASK: Thread a part with an acorn die

STANDARD: Unthreaded part must have specification length.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Acorn diehead
Thread gages
Inspection equipment
Complete job setup
Blueprint
Tools
Lubricant

PERFORMANCE GUIDE:

1. Part is made to thread major diameter.
2. Select speed and feed.
3. Acorn diehead is put on and off part.
4. Part is inspected with thread gages and inspection equipment.
5. Adjustments are made, if necessary.

DUTY: PERFORMING PRODUCTION OPERATIONS

PERFORMANCE OBJECTIVE NO. 252

TASK: Form end of workpiece with a pointing tool and holder

STANDARD: Piece part must be inspected with optical comparator for length and angle specified in blueprint specifications.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Pointing tool holder
Blueprint
Inspection equipment
Circular forming tool

Complete job setup
Tools
Optical comparator
Master profile (template)

PERFORMANCE GUIDE:

1. Position part out to stock stop.
2. Set speed and feed.
3. Cut angle and part.
4. Complete job cycle.
5. Inspect part for measurements.

DUTY: PERFORMING PRODUCTION OPERATIONS

PERFORMANCE OBJECTIVE NO. 253

TASK: Cut off parts with a straight parting tool

STANDARD: Part must be severed and checked to blueprint for length.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Straight blade cut off holder
Inspection equipment
Tools
Complete job setup
Blueprint

PERFORMANCE GUIDE:

1. Complete job cycle to cut off position.
2. Set speed and feed.
3. Sever part with cut off blade.
4. Adjust stock to proper length for next piece.
5. Inspect piece part.

DUTY: PERFORMING PRODUCTION OPERATIONS

PERFORMANCE OBJECTIVE NO. 254

TASK: Turn a part using a knee tool

STANDARD: Part must be roughed or chamfered to specification diameter.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Blueprint

Knee tool holder

Complete job setup

Tools

Inspection equipment

Cutter bits

Screw machine

PERFORMANCE GUIDE:

1. Feed bar stock to proper length.
2. With knee tool in position, adjust to proper diameter.
3. Complete cycle.
4. Inspect parts.

DUTY: PERFORMING PRODUCTION OPERATIONS

PERFORMANCE OBJECTIVE NO. 255

TASK: Recess parts using swing recessing tool

STANDARD: Part must be chamfered to 1/16 width
of blueprint specifications.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Complete job setup
Blueprint
Swing recess tool
Tool bits
Inspection equipment
Screw machine

PERFORMANCE GUIDE:

1. Adjust piece part with hole already drilled.
2. Set swing recess tool to proper depth and chamfer size.
3. Inspect severed part for proper chamfer and lack of burr.
4. Readjust, if necessary.

DUTY: PERFORMING PRODUCTION OPERATIONS

PERFORMANCE OBJECTIVE NO. 256

TASK: Cut off parts using vertical slide attachment

STANDARD: Piece parts must be within $\pm .015"$
of blueprint specifications.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Vertical cut off blade
Blueprint
Inspection equipment

Vertical slide
Tools
Complete job setup

PERFORMANCE GUIDE:

1. Adjust piece part prior to cut off position.
2. Set blade to proper center and depth.
3. Set speed and feed.
4. Sever part and check with blueprint for proper size.
5. Use minimum turn overhand from slide adjustment.

DUTY: PERFORMING PRODUCTION OPERATIONS

PERFORMANCE OBJECTIVE NO. 257

TASK: Drill parts with bottoming drills

STANDARD: Bottoming holes must be perpendicular to $\pm .010^\circ$ of inside diameter.

SOURCE FOR STANDARD: Working team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Drill tool holder

Blueprint

Measuring instruments, including
depth micrometer

Complete job setup

Tools

PERFORMANCE GUIDE:

1. Obtain a piece part with a hole prior to bottoming cycle.
2. Set bottoming drill for concentricity and depth.
3. Bottom out hole with bottoming drill.
 - a. use minimum overhang of drill
 - b. select cutting speed and feed rate
4. Inspect for hole depth and size.

DUTY: MACHINING VARIOUS MATERIALS

PERFORMANCE OBJECTIVE NO. 258

TASK: Machine mild steel

STANDARD: Parts must be machined at machinability ratings as identified in the Tool Engineering Handbook.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Mild steel
Tool machine
Carbide insert and holder
Workpiece
Cutting speed 300 feet per minute
Tool engineer's handbook

PERFORMANCE GUIDE:

1. Set RPM of spindle to match cutting speed of material.
2. Place tool, tool holder in tool post in center line of machine.
3. Set feed rate according to required depth of cut.
4. Machine part.
5. Inspect finish of part.

DUTY: MACHINING VARIOUS MATERIALS

PERFORMANCE OBJECTIVE NO. 259

TASK: Machine aluminum

STANDARD: Parts must be machined at the machinability ratings as identified in the Tool Engineering Handbook.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Aluminum
Machine
Wrenches
Tool holder
Tool bit

PERFORMANCE GUIDE:

1. Place machine at speed and feed for aluminum.
2. Place tool holder on lathe.
3. Select depth of cut.
4. Machine part.
5. Inspect for proper finish and tool life.

DUTY: MACHINING VARIOUS MATERIALS

PERFORMANCE OBJECTIVE NO. 260

TASK: Machine brass

STANDARD: Parts must be machined at the machinability ratings as identified in the Tool Engineering Handbook.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Brass
Machine Tool

PERFORMANCE GUIDE:

1. Place machine at speed and feed for brass.
2. Place tool bit and holder on lathe.
3. Select depth of cut.
4. Machine part.
5. Inspect for proper finish and tool life.

DUTY: MACHINING VARIOUS MATERIALS

PERFORMANCE OBJECTIVE NO. 261

TASK: Machine plastics

STANDARD: Parts must be machined at machinability ratings as identified in the Tool Engineering Handbook.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Plastics workpiece
Machine tool and accessories

PERFORMANCE GUIDE:

1. Set up required tooling.
2. Set speed and feed.
3. Machine part.
4. Inspect for proper finish.

DUTY: MACHINING VARIOUS MATERIALS

PERFORMANCE OBJECTIVE NO. 262

TASK: Machine stainless steels

STANDARD: Parts must be machined at machinability ratings as identified in the Tool Engineering Handbook.

SOURCE FOR STANDARD: Writing team of incumbent workers

CONDITIONS FOR PERFORMANCE OF TASK:

Stainless steel
Machine tool

PERFORMANCE GUIDE

1. Set up required tooling.
2. Set speed and feeds.
3. Select depth of cut.
4. Machine part.
5. Inspect for finish and tool life.

APPENDIX

APPENDIX A
Cross Reference Table of Duties and Tasks
Machine Tool Operations

DOT: 603.280-018
Tool Grinder Operator

DOT: 604.685-026
Production Lathe Operator

DOT: 604.685-034
Production Screw Machine Operator

Respondents: n = 50

DUTY/TASK	Task/Page Number	Percent Performing		
		GRI	LAT	SCR
A. Performing Supervisory Functions				
01 (A-2, A-3) Determine availability of supplies and materials	1/10	17.6	41.2	42.9
02 (see A-1) Maintain files	--	11.8	23.5	11.1
03 (see A-1) Order and receive stock	--	17.6	29.4	11.1
04 Follow up on end product quality control standards	2/11	17.6	35.3	11.1
05 Supervise machine use and operation	3/12	11.8	35.3	11.1
06 (A-7, A-8) Supervise maintenance of shop safety equipment	4/13	11.8	41.2	11.1
07 (see A-6) Supervise safe operations	--	11.8	47.1	11.1
08 (see A-6) Supervise setup of machinery	--	11.8	41.2	11.1
09 Inventory supplies and materials	5/14	11.8	41.2	11.1
B. Performing Mathematical Calculations				
01 Perform basic mathematical calculations	6/15	29.4	64.7	44.4

DUTY/TASK	Task/Page Number	Percent Performing		
		Gri	Lat	Scr
02 Calculate amount of material to be removed to obtain correct limits for rework	7/16	23.5	58.8	22.2
03 Calculate change gearing for threading	--	11.8	35.3	11.1
04 Calculate conversion of revolutions per minute (RPM) to surface feet per minute (SFPM)	3/17	17.6	52.9	22.2
05 Calculate dimensions of slots and grooves on special setups	9/18	17.6	52.9	44.4
06 Calculate gear blank specifications for indexing	10/19	11.8	17.6	11.1
07 Calculate machine speeds and feeds by formula	11/20	17.6	52.9	22.2
08 Calculate stock utilization in machine work	12/1	17.6	47.1	22.2
09 Calculate tolerances or allowances for proper fits	3/2	23.5	52.9	33.3
10 Convert to metric measurement	14/23	17.6	41.2	11.1
11 Determine clearance relief, and rake of cutting tools	5/4	29.4	47.1	33.3
12 Determine material strength according to standard raw stock sizes	6/5	11.8	35.3	22.2

DUTY/TASK	Task/Page Number	Percent Performing		
		Gri	Lat	Scr
13 Take micrometer readings to determine shaft diameter	17/26	23.5	64.7	44.4
C. Designing and Planning Machine Work				
01 Make sketches of parts to be machined	18/27	23.5	47.1	22.2
02 Perform layout for precision machine work using layout instruments	19/28	41.2	52.9	11.1
03 Locate holes from edge of work piece using milling machine	20/29	41.2	47.1	11.1
04 (E-4) Inspect, remove, and replace part(s) for repair or machine work	21/30	52.9	64.7	33.3
05 Test for hardness	22/31	47.1	23.5	11.1
D. Performing Metalwork Operations				
01 (C-5) Clamp work in holding device	23/32	88.2	88.2	44.4
02 Cut metal stock	24/33	88.2	94.1	44.4
03 Fabricate special cutting tools	25/34	88.2	70.6	33.3
04 Heat treat metal	26/35	82.4	52.9	11.1
05 (G-7) Operate cylindrical grinder	27/36	82.4	41.2	22.2
06 (E-5) Operate hone to apply proper surface in a cylinder	28/37	76.5	52.9	22.2
07 Perform bench cross filing	29/38	94.1	82.4	55.6
08 Polish metal	30/39	82.4	76.5	55.6
09 Measure with depth gages in boring and milling processes	31/40	88.2	64.7	44.4

DUTY/TASK	Task/Page Number	Percent Performing		
		Gri	Lat	Scr
10 Measure concentricity with dial test indicator	32/41	88.2	70.6	33.3
11 (D-12, D-13) Check layout with gage blocks	--	82.4	70.6	22.2
12 (see D-11) Determine accuracy of precision measurement instruments with gage blocks	--	88.2	64.7	33.3
13 (see D-11) Measure with height gages using gage blocks	33/42	82.4	58.8	33.3
14 Measure with sine bar using gage blocks	34/45	82.4	47.1	11.1
E. Performing Bench Work				
01 (E-2) Cut materials with hand hacksaws	35/44	82.4	70.6	22.2
02 (E-1) Cut threads with hand taps	--	82.4	76.5	33.3
03 Cut threads with dies	36/45	82.4	76.5	33.3
04 (see C-4) Disassemble and assemble parts	--	88.2	76.5	33.3
05 (see D-6) Hone and lap surfaces	--	82.4	58.8	0
06 Hand sharpen cutting tools with abrasive stones	37/46	88.2	70.6	33.3
07 (F-6) Ream holes with hand reamers	38/47	82.4	70.6	33.3
08 Remove and replace helical coil wire screw thread insert (STI)	39/48	76.5	52.9	0

DUTY/TASK	Task/Page Number	Percent Performing		
		Gri	Lat	Scr
09 Remove damaged screws and other non-hardened threaded hardware	40/49	88.2	58.8	11.1
10 Work and shape metal	41/50	82.4	52.9	11.1
F. Operating Drill Presses				
01 Center punch hole location	42/51	88.2	70.6	22.2
02 Counterbore to depth specified in blueprint	43/52	88.2	70.6	44.4
03 Countersink hole to drawing requirements	44/53	88.2	64.7	55.6
04 (F-9) Drill hole to size	45/54	88.2	76.5	55.6
05 Mount and secure work in proper holding device	46/55	88.2	70.6	44.4
06 (see E-7) Ream hole to size	--	88.2	64.7	55.6
07 (F-5) Sharpen drill using grinding wheel and fixture	47/56	82.4	70.6	44.4
08 Sharpen drill bit free hand against grinding wheel and check for sharpness	48/57	82.4	58.8	33.3
09 (see E-4) Select and secure tool or cutter for drill press operation	--	82.4	58.8	33.3
10 Set drill press for proper feed rate and RPM of spindle	49/58	82.4	58.8	33.3
11 Spot-free workpiece	50/59	76.5	47.1	22.2

DUTY/TASK	Task/Page Number	Percent Performing		
		Gri	Lat	Scr
12 Hand tap hole to blueprint specifications	51/60	76.5	64.7	33.3
13 Adjust automatic feed on drill press	52/61	82.4	35.3	11.1
G. Operating Grinding Machines				
01 Attach and align materials for grinding operations	53/62	100	29.4	11.1
02 Balance grinding wheel	54/63	100	29.4	11.1
03 Cut off part with grinding machines	55/64	94.1	35.3	0
04 (D-5) Dress and true grinding wheels	56/65	100	47.1	22.2
05 Inspect grinding wheels	57/66	100	41.2	11.1
06 Measure, inspect, and rework work-piece on grinding machines	58/67	94.1	35.3	22.2
07 (see D-5) Perform grinding machine operations as per setup	--	100	29.4	11.1
08 Polish with grinding machine	59/68	88.2	17.6	0
09 (B-11, B-12) Select and set speeds and feeds of power feed grinders	60/69	88.2	29.4	11.1
10 Set up and perform surface grinding operations	61/70	100	41.2	11.1
11 (C-4) Set up grinder and sharpen plain milling cutters	62/71	94.1	5.9	0
12 Set up, grind, and sharpen preshaped lathe tools	63/72	88.2	4.12	11.1
13 Set up grinder and shape chisels	64/73	82.4	35.3	0

DUTY/TASK	Task/Page Number	Percent Performing		
		Gri	Lat	Scr
14 Set up grinder to run workpiece between centers	65/74	94.1	17.6	11.1
15 Set up surface grinder to run on magnetic chuck	66/75	88.2	35.3	11.1
H. Operating Lathes				
01 Align lathe centers using approximate method	67/76	23.5	52.9	22.2
02 Align lathe centers using accurate measurement	68/77	17.6	64.7	11.1
03 (D-5) Bore holes with lathe	69/78	23.5	76.5	44.4
04 (D-10) Counterbore holes with lathe	70/79	23.5	76.5	44.4
05 Countersink holes using lathe	71/80	23.5	76.5	44.4
06 (C-7) Using taper attachment cut long external tapered surfaces	72/81	17.6	52.9	0
07 Using compound rest, cut short external tapered surfaces	73/82	11.8	58.8	11.1
08 Cut internal threads with lathe	74/83	17.6	70.6	11.1
09 (D-7) Cut external threads with lathe	75/84	17.6	70.6	22.2
10 (D-18) Cut internal tapered surfaces	76/85	17.6	58.8	0
11 Die cut threads with lathe, hand threading	77/86	23.5	70.6	22.2
12 Die cut threads with lathe using die heads	79/37	23.5	76.5	44.4
13 Drill holes with lathe	79/88	23.5	76.5	44.4

DUTY/TASK	Task/Page Number	Percent Performing		
		Gri	Lat	Scr
14 Set up lathe and face workpiece held in chucks	80/89	17.6	70.6	33.3
15 Perform contour, angular, or radii cuts with lathe	81/90	17.6	64.7	22.2
16 Perform lathe filing	92/91	23.5	70.6	44.4
17 (D-27) Perform lathe filing to deburr part	33/92	23.5	82.4	44.4
18 Perform spinning operation using forming tool	84/93	11.8	35.3	11.1
19 (C-2) Ream holes with lathe	85/94	17.6	82.4	44.4
20 Recut threads on lathe	86/95	17.6	76.5	33.3
21 (D-2) Rough cut and finish cut with lathe	87/96	17.6	88.2	33.3
22 (D-16) Knurl parts with lathe	83/97	17.6	64.7	22.2
23 Secure tool holder, fixtures, or attachments	99/98	23.5	70.6	22.2
24 Select and set speeds and feeds	90/99	17.6	70.6	33.3
25 Set up engine lathe	91/100	17.6	70.6	11.1
26 Set up turret lathe for operations	92/101	17.6	58.8	11.1
27 Tap threads with lathe	93/102	23.5	76.5	33.3
28 Set up tool post grinder	94/103	11.8	58.8	0
I. Operating Milling Machines				
01 Align milling machine fixtures	95/104	11.8	35.3	22.2
02 Align milling machine attachments	96/105	17.6	35.3	22.2

DUTY/TASK	Task/Page Number	Percent Performing		
		Gri	Lat	Scr
03 Assemble completed mill work	97/106	11.8	35.3	22.2
04 Bore holes with milling machines	98/107	11.8	35.3	22.2
05 Bore for a finish bushing fit	99/108	11.8	35.3	11.1
06 Bore to remove bushings	100/109	5.9	35.3	0
07 Cut external keyway	101/110	11.8	35.3	22.2
08 Drill holes with milling machine	102/111	17.6	35.3	33.3
09 Duplicate on the profile milling machine	--	11.8	11.8	0
10 Inspect completed mill work	103/112	11.8	35.3	22.2
11 Mill an angle	104/113	17.6	35.3	22.2
12 Mill an external radius	105/114	11.8	29.4	11.1
13 Mill cylindrical work piece	106/115	11.8	29.4	0
14 Mill spur gears	107/116	5.9	11.8	0
15 Mill internal slots using slotter and attachments	108/117	5.9	5.9	11.1
16 Perform end milling	109/118	17.6	29.4	33.3
17 Perform flycutting operations	110/119	11.8	35.3	22.2
18 Perform form milling	--	11.8	23.5	0
19 Perform indexing operations	111/120	5.9	35.3	22.2
20 Perform reaming operations	112/121	17.6	41.2	44.4
21 Perform cutting-off operations	113/122	11.8	35.3	0
22 Perform straddle milling operations on the horizontal mill	114/123	11.8	29.4	11.1

DUTY/TASK	Task/Page Number	Percent Performing		
		Gri	Lat	Scr
23 Select and set speeds and feeds for milling work	115/124	11.8	23.5	33.3
24 Square workpiece using dividing head	116/125	5.9	23.5	0
25 Square workpiece using table vise	117/126	17.6	35.3	44.4
J. Operating Power Saws				
01 Cut and weld bandsaw blades to insert for contour sawing	118/127	29.4	47.1	22.2
02 Measure material and cut off material with power hacksaw	119/128	29.4	64.7	33.3
03 Remove and replace saw blades	120/129	29.4	58.8	44.4
04 Saw with a metal band saw to scribed lines	121/130	29.4	52.9	44.4
05 Select and set speeds and feeds for sawing operations	122/131	23.5	52.9	22.2
06 Select and install appropriate blades	123/132	29.4	52.9	33.3
K. Operating Presses				
01 Set up and punch materials with press	124/133	58.8	41.2	11.1
02 Select accessories and attachments for press work	125/134	64.7	41.2	0
03 Set up press and assemble parts with presses	126/135	64.7	35.3	0
04 Set up press and disassemble parts with presses	127/136	64.7	29.4	0

DUTY/TASK	Task/Page Number	Percent Performing		
		Gri	Lat	Scr
05 Straighten miscellaneous parts with presses	128/137	64.7	41.2	11.1
06 Set up, remove, and replace parts with presses	129/138	64.7	35.3	11.1
L. Operating Shapers				
01 Align shaper attachment, workpiece, and cutting tool	130/139	52.9	17.6	0
02 Select and set speeds and feeds of shapers	131/140	52.9	17.6	0
03 Select, shape, and sharpen cutting tools for shaper operation	132/141	52.9	17.6	0
M. Performing Production Machinist Line Work				
01 Remove and install pins	133/142	70.6	64.7	22.2
02 (see) Remove defective splines and replace with new splines	--	70.6	35.3	11.1
03 Remove frozen or seized parts	134/143	70.6	52.9	33.3
N. Maintaining Machines and Tools				
01 Inspect and change drive pulleys or belts	135/144	88.2	58.8	33.3
02 Clean and store hand tools, cutters, fixtures, jigs, or attachments	136/145	88.2	64.7	44.4
03 Install, level, and fasten down machines	137/146	82.4	47.1	11.1
04 Replace and adjust machine parts	139/147	82.4	58.8	11.1

DUTY/TASK	Task/Page Number	Percent Performing		
		Gri	Lat	Scr
05 Inspect and remove, replace, or adjust machine guards	139/148	88.2	70.6	44.4
06 Scrape and paint machines	140/149	23.5	29.4	44.4
07 Inspect and repair hand tools	141/150	82.4	64.7	11.1
08 Store grinding wheels	142/151	82.4	41.2	22.2
09 Store precision tools	143/152	88.2	58.8	11.1
10 Perform maintenance on lathe	144/153	41.2	58.8	22.2
11 Perform maintenance on milling machine	145/154	35.3	52.9	11.1
12 Perform maintenance on drill press	146/155	52.9	58.8	22.2
13 Perform maintenance on grinder	147/156	88.2	47.1	22.2
14 Perform maintenance on bandsaw	148/157	41.2	52.9	22.2
15 Select coolants, cutting oils, or compounds for machining operation	149/158	76.5	52.9	22.2
16 Clean arbor presses	150/159	76.5	29.4	0
17 Lubricate arbor press	151/160	76.5	23.5	11.1
18 Clean hydraulic press	152/161	70.6	29.4	0
19 Lubricate hydraulic presses	153/162	70.6	29.4	11.1
20 Inspect arbor presses for safe operational condition	154/163	76.5	29.4	11.1
21 Inspect hydraulic press for safe operational condition	155/164	70.6	23.5	0
22 Inspect work area for safe working environment	156/165	82.4	41.2	22.2

DUTY/TASK	Task/Page Number	Percent Performing		
		Gri	Lat	Scr
0. Maintaining Shop Facilities and Work Areas				
01 (H-2) Dispose of scrap metal, chips or shavings and trash or waste materials	157/166	94.1	70.6	55.6
02 (see 0-3) Perform custodial tasks	--	58.8	58.8	55.6
03 (H-5) Clean and maintain work areas	158/167	94.1	64.7	55.6
04 (see 0-3) Paint facilities	--	29.4	47.1	55.6
05 (see 0-3) Sweep and clean shop facility	--	47.1	58.8	55.6
PRODUCTION LATHE OPERATOR				
A. Read and Interpret Blueprints				
01 (A-1) Interpret metric blueprints	159/168	29.4	35.3	11.1
02 (A-2) Interpret geometric blueprints	160/169	23.5	47.1	11.1
03 (A-3) Read information blocks	161/170	17.6	58.8	22.2
B. Performing Mathematical Calculations				
01 (see B-1) Calculate stock used for job	--	11.8	47.1	22.2
02 (see B-1) Add and subtract whole numbers	--	17.6	64.7	44.4
03 (see B-1) Multiply and divide whole numbers	--	17.6	58.8	44.4
04 (see B-1) Add and subtract fractions	--	52.9	44.4	42.9
05 (see B-1) Multiply and divide fractions	--	17.6	52.9	33.3
06 (see B-1) Find the lowest common denominator	--	11.8	58.8	33.3
07 (see B-1) Add and subtract mixed numbers	--	11.8	58.8	44.4

DUTY/TASK	Task/Page Number	Percent Performing		
		Gri	Lat	Scr
08 (see B-1) Multiply and divide mixed numbers	--	11.8	58.8	33.3
09 Convert fractions and metrics to decimals	162/171	11.8	58.8	44.4
10 Convert decimals to drill sizes using a conversion chart	163/172	17.6	64.7	44.4
C. Using Workholding Devices				
01 (see C-4) Check part for defects	--	23.5	70.6	33.3
02 (see H-19) Machine parts between centers	--	23.5	58.8	11.1
03 Machine parts using center drivers	164/173	23.5	47.1	11.1
04 Install work piece in 3-jaw chuck	165/174	23.5	82.4	44.4
05 Install work piece in 4-jaw chuck	166/175	23.5	64.7	44.4
06 Machine parts using air chucks	167/176	17.6	4.12	33.3
07 (see H-6) Cut taper with taper fixture	--	17.6	47.1	0
08 Machine parts using collet chucks	169/177	17.6	58.8	33.3
09 Install work piece on faceplate	169/178	23.5	70.6	0
10 Machine parts with magnetic chucks	170/179	17.6	29.4	11.1
D. Performing Production Operations				
01 (see C-4) Load work piece	--	23.5	76.5	33.3
02 (see H-21) Turn parts	--	23.5	82.4	44.4
03 (G-6) Adjust coolant system	171/180	23.5	64.7	44.4
04 Drill holes with jacobs chuck	172/181	23.5	64.7	44.4
05 (see H-3) Bore parts	--	23.5	70.6	33.3

DUTY/TASK	Task/Page Number	Percent Performing		
		Gri	Lat	Scr
06 (see H-19) Ream parts	--	23.5	64.7	44.4
07 (see H-9) Single point thread parts	--	17.6	64.7	11.1
08 (E-7) Thread parts using taps	173/182	23.5	52.9	33.3
09 (E-6) Thread parts using dies	174/183	23.5	58.8	44.4
10 (see H-4) Counterbore parts	--	17.6	58.8	44.4
11 Face parts	175/184	17.6	64.7	44.4
12 Turn stock to precision length	176/185	17.6	58.8	44.4
13 Adjust stops	177/186	17.6	58.8	44.4
14 Adjust micrometer collars	178/187	17.6	47.1	33.3
15 (see C-4) Load bar feed	--	11.8	35.3	22.2
16 (see H-22) Knurl parts	--	17.6	41.2	33.3
17 (E-15) Turn tapers	179/188	17.6	64.7	11.1
18 (see H-10) Form angles	--	17.6	76.5	44.4
19 Machine a radius	180/189	17.6	76.5	11.1
20 Center drill parts	181/190	23.5	82.4	44.4
21 Spot face parts	182/191	17.6	64.7	22.2
22 (F-19) Install a steady rest	183/192	17.6	64.7	22.2
23 (F-13) Use a follower rest	184/193	11.8	52.9	11.1
24 (see H-10) Bore a taper	--	17.6	64.7	11.1
25 Recess a part	185/194	17.6	70.6	22.2
26 Cut off parts	186/195	17.6	70.6	44.4
27 (H-17, E-23) Deburr parts	--	23.5	76.5	44.4
28 Adjust manual feed levers	187/196	17.6	47.1	33.3
29 Adjust power feed	188/197	17.6	47.1	22.2

DUTY/TASK	Task/Page Number	Percent Performing		
		Gri	Lat	Scr
E. Machining Various Materials				
01 (see F-2) Machine mild steel	--	23.5	76.5	44.4
02 (see F-5) Machine plastics	--	17.6	70.6	44.4
03 (see F-3) Machine aluminum	--	17.6	70.6	44.4
04 (see F-4) Machine brass	--	17.6	70.6	44.4
05 Machine castings	--	17.6	64.7	33.3
06 Machine forgings	--	17.6	52.9	33.3
07 (see F-2) Machine tool steel	--	17.6	58.8	22.2
08 (see F-6) Machine stainless steel	--	17.6	76.5	44.4
F. Changing Lathe Tools				
01 Inspect lathe tools	189/198	23.5	88.2	33.3
02 (F-3) Remove and replace tools	190/199	23.5	88.2	33.3
03 (see F-2) Replace tools	--	23.5	88.2	33.3
04 Adjust tooling	191/200	17.6	82.4	44.4
05 (see F-7) Sharpen drills	--	17.6	76.5	44.4
06 (F-7, F-8) Sharpen turning tools	192/201	17.6	76.5	33.3
07 (see F-6) Sharpen form tools	--	17.6	58.8	33.3
08 (see F-6) Charpen boring bars	--	17.6	70.6	33.3
09 Change carbide inserts	193/202	17.6	82.4	11.1
10 (see C-6) die chasers	--	11.8	47.1	33.3
11 (see F-4) Set tool to center height	--	17.6	52.9	44.4
G. Inspecting Parts				
01 Calibrate micrometers	194/203	17.6	64.7	11.1
02 (K-15) Measure with micrometers	195/204	17.6	88.2	44.4

DUTY/TASK	Task/Page Number	Percent Performing		
		Gri	Lat	Scr
03 Measure with dial calipers	196/205	17.6	76.5	44.4
04 (G-7, G-9) Measure with fixed gages	197/206	17.6	70.6	22.2
05 Measure with rule	198/207	17.6	82.4	44.4
06 (K-14) Measure out around using dial indicators	199/208	17.6	70.6	33.3
07 (see G-4) Measure with plug gages	--	17.6	70.6	33.3
08 (K-13) Measure diameter and taper with bore gages	200/209	11.8	76.5	22.2
09 (G-4) Measure with snap gages	--	11.8	35.3	0
10 (K-16) Measure with an optical comparator	201/210	17.6	52.9	33.3
11 Measure inside diameters using telescoping gage	202/211	17.6	58.8	22.2
12 Measure with radius gages	203/212	17.6	58.8	22.2
13 Inspect threads	204/213	17.6	64.7	33.3
H. Maintaining Work Area				
01 (H0-4) Change coolant	205/214	23.5	70.6	44.4
02 (see O-1) Remove chips	--	23.5	82.4	44.4
03 (see D-3) Clean work area	--	23.5	82.4	44.4
04 (see H-1) Add coolant when necessary	--	23.5	76.5	44.4
05 Check and maintain oil level in base of machine	#			
06 Lubricate machine in areas	#			
07 Check and maintain oil level in automatic oiler reservoir	#			

DUTY/TASK	Task/Page Number	Percent Performing		
		Gri	Lat	Scr
TOOL GRINDER OPERATOR				
A. Interpreting Blueprints				
01 (see A-1) Interpret metric blueprints	--	82.4	17.6	11.1
02 (see A-2) Interpret geometric blueprints	--	88.2	29.4	0
03 (see A-3) Read information blocks	--	88.2	29.4	0
B. Performing Mathematical Calculations				
01 (see B-1) Add and subtract whole numbers	--	94.0	35.3	22.2
02 (see B-1) Multiply and divide whole numbers	--	94.1	29.4	22.2
03 (see B-1) Add and subtract fractions	--	94.1	29.4	22.2
04 (see B-1) Multiply and divide fractions	--	94.1	29.4	22.2
05 (see B-1) Find the lowest common denominator	--	82.4	29.4	11.1
06 (see B-1) Add and subtract mixed numbers	--	82.4	29.4	22.2
07 (see B-1) Multiply and divide mixed numbers	--	88.2	29.4	22.2
08 (see B-1) Convert fractions and metrics to decimals	--	88.2	23.5	22.2
09 (see B-1) Convert decimals to drill sizes using a conversion chart	--	88.2	11.8	22.2
10 (see F-17) Calculate tapers	--	94.1	11.8	11.1

DUTY/TASK	Task/Page Number	Percent Performing		
		Gri	Lat	Scr
11 (see G-9) Calculate grinding speeds	--	76.5	5.9	11.1
12 (see G-9) Calculate grinding feeds	--	82.4	5.9	11.1
13 Calculate rework dimensions	--	94.1	5.9	0
C. Using Workholding Devices				
01 (see C-10) Install workpiece in magnetic chucks	--	94.1	5.9	11.1
02 (see C-4) Install workpiece in 3-jaw chucks	--	94.1	23.5	22.1
03 (see C-5) Install workpiece in 4-jaw chucks	--	88.2	23.5	22.2
04 (see C-9) Adjust faceplate	--	82.4	23.5	11.1
05 (see D-1) Install workpiece in vises	--	100	17.6	22.2
06 Install workpiece on magnetic parallel	206/215	94.1	5.9	0
07 Install workpiece in vacuum chuck	207/216	76.5	0	11.1
08 (see C-9) Grind parts between centers	--	88.2	0	11.1
09 (see C-8) Grind parts using fixtures	--	88.2	5.9	11.1
D. Setting Up Surface Grinders				
01 (see G-10) Plan sequence of operations	--	82.4	23.5	11.1
02 (E-2) Select workholding device	208/217	82.4	29.4	11.1
03 (E-3) Select grinding wheels	209/218	88.2	29.4	22.2
04 (E-4) Mount grinding wheels	210/219	88.2	35.3	22.2
05 (see E-5) True and dress grinding wheels	--	88.2	35.3	22.2

DUTY/TASK	Task/Page Number	Percent Performing		
		Gri	Lat	Scr
06 (see E-6) Select feed rates	--	76.5	29.4	22.2
07 (see E-7) Select grinding speeds	--	76.5	23.5	22.2
08 (see E-8) Calculate depth of cut	--	76.5	35.3	22.2
09 (E-9) Set trip dogs on grinder table	211/220	76.5	35.3	11.1
10 (E-10, F-10) Dress wheel to angles	212/221	88.2	17.6	11.1
11 (E-11, F-11) Dress wheel to a radius	213/222	88.2	11.8	11.1
12 (see E-12) Set up tracer attachment	--	76.5	5.9	0
E. Setting Up Internal Grinder				
01 (see D-1) Plan sequence of operations	--	70.6	0	0
02 (see D-2) Select workholding device	--	70.6	0	0
03 (see D-3) Select grinding wheel	--	70.6	0	0
04 (see D-4) Mount grinding wheel and replace guard	--	70.6	0	0
05 (see D-5) True and dress grinding wheel	--	70.6	0	0
06 (see D-6) Select feed rates	--	70.6	0	0
07 (see D-7) Select grinding speeds	--	70.6	0	0
08 (see D-8) Calculate depth of cut	--	64.7	0	0
09 (see D-9) Set depth of cut using table stop	--	70.6	0	0
10 Set feed depth using wheelhead stops	214/223	58.8	0	0
11 Set feed depth using workhead stops	215/224	64.7	0	0
12 (see D-12) Set up tracer attachment	--	58.8	0	0

DUTY/TASK	Task/Page Number	Percent Performing		
		Gri	Lat	Scr
F. Setting Up External Grinder				
01 (see D-1) Plan sequence of operations	--	70.6	0	11.1
02 (see D-2) Select workholding device	--	70.6	0	11.1
03 (see D-3) Select grinding wheel	--	70.6	0	11.1
04 (see D-4) Mount grinding wheel and replace guard	--	70.6	0	11.1
05 (see D-5) True and dress grinding wheel	--	70.6	0	11.1
06 (see D-6) Select feed rates	--	70.6	0	11.1
07 (see D-7) Select grinding speeds	--	70.6	0	11.1
08 (see D-8) Calculate depth of cut	--	64.7	0	11.1
09 Adjust workpiece with table stops	216/225	70.6	0	11.1
10 Adjust workpiece with wheelhead stops	217/226	58.8	0	11.1
11 Set rapid travel	218/227	58.8	0	0
12 Set feed travel	219/228	70.6	0	0
13 (see D-10) Dress wheel to angles	--	70.6	0	11.1
14 (see D-11) Dress wheel to radius	--	70.6	0	11.1
15 Dress wheel to complex profile	220/229	70.6	0	0
16 (see D-12) Set up tracer attachment	--	64.7	0	0
17 (see B-10) Set up a taper	--	70.6	0	0
18 (see D-23) Set up a follower rest	--	58.8	0	0
19 (see D-22) Set up a steady rest	--	64.7	0	0
G. Operating Surface Grinders				
01 (see H-1) Check part	--	88.2	23.5	11.1

DUTY/TASK	Task/Page Number	Percent Performing		
		Gri	Lat	Scr
02 (see G-15) Install workpiece in holding device	--	88.2	29.4	11.1
03 (see G-15) Touch off part	--	82.4	23.5	11.1
04 Operate grinder manually	221/230	88.2	23.5	11.1
05 Operate grinder using power feed	222/231	82.4	11.8	0
06 (see D-3) Adjust feed rate of coolant	--	82.4	23.5	0
07 (H-9) Grind parts to size	223/232	88.2	23.5	11.1
08 (H-7) Grind an angle	224/233	88.2	17.6	11.1
09 (G-10) Grind a radius on surface grinder	225/234	88.2	11.8	11.1
10 (see G-9) Grind complex profiles	--	82.4	11.8	0
11 Grind to remove warp	226/235	88.2	23.5	0
12 (H-12) Grind to a shoulder	227/236	88.2	23.5	11.1
13 Grind parallel surfaces	228/237	88.2	23.5	11.1
14 Grind square surfaces	229/238	88.2	23.5	11.1
H. Operating Internal Grinder				
01 (see G-1) Check part	--	76.5	0	0
02 (see G-2) Install workpiece in workholding device	--	76.5	0	0
03 (see G-3) Touch off part	--	70.6	0	0
04 (see G-4) Operate grinder manually	--	76.5	0	0
05 (see G-5) Operate grinder using power feeds	--	76.5	0	0
06 (see D-3) Adjust feed rate of coolant	--	76.5	0	0

DUTY/TASK	Task/Page Number	Percent Performing		
		Gri	Lat	Scr
07 (see G-7) Grind through parts	--	76.5	0	0
08 (see G-8) Grind blind holes	--	70.6	0	0
09 (G-9) Grind parts to size	--	76.5	0	0
10 (see H-15) Grind internal tapers	230/239	76.5	0	0
11 (see I-15) Face grind	--	76.5	0	0
12 (see G-12) Grind to a shoulder	--	76.5	0	0
13 Grind an internal radius	231/240	70.6	0	0
14 Grind an internal recess	232/241	70.6	0	0
15 (see H-10) Grind an internal angle	--	76.5	0	0
I. Operating External Grinder				
01 (see G-1) Check part	--	76.5	0	11.1
02 (see G-2) Install workpiece in holding device	--	76.5	0	11.1
03 (see G-3) Touch off part	--	70.6	0	11.1
04 (see G-4) Operate grinder manually	--	76.5	0	11.1
05 (see G-5) Operate grinder using power feed	--	70.6	0	0
06 (see G-6) Adjust feed rate of coolant	--	76.5	0	11.1
07 (see G-7) Grind parts to size	--	76.5	0	11.1
08 (see G-8) Grind an angle	--	76.5	0	11.1
09 (see G-9) Grind a radius	--	76.5	0	11.1
10 (see G-10) Grind complex profiles	--	70.6	0	0
11 Grind a taper	233/242	76.5	0	11.1
12 (see G-12) Frind to a shoulder	--	76.5	0	11.1

DUTY/TASK	Task/Page Number	Percent Performing		
		Gri	Lat	Scr
13 (see D-23) Install and adjust a follower rest	--	64.7	0	0
14 (see D-22) Install and adjust a steady rest	--	64.7	0	0
15 (see H-11) Face grind a part	--	76.5	0	11.1
16 (see H-11) Face grind a part	--	82.4	5.9	11.1
17 (see H-14) Grind a recess	--	76.5	5.9	11.1
J. Grinding Various Materials				
01 (see G-7) Grind mild steel	--	76.5	35.3	11.1
02 (see G-7) Grind hardened steel	--	82.4	35.3	11.1
03 (see G-7) Grind non-ferrous materials	--	76.5	17.6	11.1
04 Grind plastics	--	0	23.5	0
K. Inspecting Parts				
01 (see G-1) Calibrate micrometers	--	82.4	11.8	11.1
02 (see G-2) Measure with micrometers	--	82.4	11.8	11.1
03 (see G-3) Measure with calipers	--	76.5	11.8	11.1
04 (see G-4) Measure with fixed gages	--	76.5	11.8	11.1
05 (see G-5) Measure with rule	--	82.4	11.8	11.1
06 (see G-6) Measure out around using dial indicators	--	82.4	11.8	11.1
07 (see D-13) Measure with surface plates	--	82.4	11.8	11.1
08 (see D-13) Measure with gage blocks	--	76.5	11.8	11.1
09 (see G-10) Measure with an optical comparator	--	76.5	11.8	11.1

DUTY/TASK	Task/Page Number	Percent Performing		
		Gri	Lat	Scr
10 Identify surface finishes	234/243	76.5	11.8	11.1
11 (see G-12) Measure with radius gages	--	82.4	11.8	11.1
12 (see D-14) Perform angular measurement	--	82.4	11.8	11.1
13 (see G-8) Measure tapers	--	76.5	11.8	11.1
14 (see G-6) Measure using indicating micrometers	--	76.5	11.8	11.1
15 (see G-2) Measure using V-anvil micrometers	--	76.5	11.8	11.1
16 (see G-10) Compare machined part with templates	--	76.5	11.8	0
17 (see H-1) Inspect parts	--	70.6	5.9	0
L. Maintaining Shop and Work Area				
01 (see H-4) Add coolant when necessary	--	82.4	5.9	11.1
02 (see H-1) Change coolant	--	82.4	5.9	11.1
03 (see H-3) Clean work area	--	82.4	5.9	11.1
PRODUCTION SCREW MACHINE OPERATOR				
A. Reading and Interpreting Blueprints				
01 (see A-1) Interpret metric blueprints	--	11.8	0	55.6
02 (see A-2) Interpret geometric blueprints	--	5.9	0	66.7
B. Performing Mathematical Calculations				
01 (see B-2) Add and subtract whole numbers	--	5.9	0	88.9

DUTY/TASK	Task/Page Number	Percent Performing		
		Gri	Lat	Scr
02 (see B-3) Multiply and divide whole numbers	--	5.9	0	88.9
03 (see B-4) Add and subtract fractions	--	5.9	0	88.9
04 (see B-5) Multiply and divide fractions	--	5.9	0	88.9
05 (see B-6) Find the lowest common denominator	--	0	0	77.8
06 (see B-7) Add and subtract mixed numbers	--	0		
07 (see B-8) Multiply and divide mixed numbers	--		0	88.9
08 (see B-9) Convert fractions to decimals	--	5.9	5.9	88.9
09 (see B-10) Convert decimals to drill size using a conversion chart	--	0	17.6	77.8
C. Changing Tools				
01 Remove tools	235/244	0	11.8	77.8
02 Inspect tools	236/245	0	11.8	77.8
03 Replace and adjust tools	237/246	0	11.8	77.8
04 (see G-11) Sharpen circular tools	--	0	5.9	77.8
05 Sharpen lathe tool	238/247	0	5.9	77.8
06 (F-10) Adjust chasers for thread size	239/248	0	5.9	88.9
07 Sharpen drills	240/249	0	11.8	66.7

DUTY/TASK	Task/Page Number	Percent Performing		
		Gri	Lat	Scr
D. Loading Bar Stock				
01 Deburr stock	241/250	0	17.6	77.8
02 Open chuck and install new bar	242/251	0	17.6	77.8
03 Index and position turret	243/252	0	11.8	88.9
04 Start machine and operate	244/253	0	17.6	77.8
05 Inspect first part	245/254	0	11.8	77.8
06 Load and adjust part using electric automatic rod magazine	--	0	0	55.6
07 Load and adjust part using a roller feed	--	0	0	55.6
08 Load and adjust part using a mechani- cal automatic rod magazine	--	0	5.9	55.6
09 Adjust feed finger to proper tension	#			
10 Adjust collect tension	#			
E. Performing Production Operations				
01 Machine forms with circular tools	246/255	0	5.9	77.8
02 Cut off parts with circular tools	--	0	5.9	66.7
03 Turn diameters with roller box turning tools	247/256	0	5.9	88.9
04 Feed parts to a swing stop	--	0	0	66.7
05 Feed parts to a turret stop	248/257	0	11.8	88.9
06 (see D-9) Thread a part using a die	--	0	11.8	88.9
07 (see D-8) Thread a part using a tap	--	0	11.8	88.9
08 Thread a part using an opening die holder	249/258	0	5.9	88.9

DUTY/TASK	Task/Page Number	Percent Performing		
		Gri	Lat	Scr
09 Rough turn parts with a balance turning tool	250/259	0	5.9	77.8
10 (see D-4) Center and drill parts	--	0	11.8	88.9
11 (see D-6) Ream parts	--	0	11.8	88.9
12 Support a part with a back rest	--	0	0	66.7
13 Thread a part with an acorn die	251/260	0	5.9	77.8
14 Turn and form with a swing tool	--	0	5.9	66.7
15 (see D-17) Turn a taper	--	0	5.9	66.7
16 (see D-16) Knurl a part	--	0	5.9	88.9
17 Form the end of workpiece with a pointing tool	252/261	0	0	66.7
18 Cut off parts with a straight cut off tool	253/262	0	11.8	88.9
19 Turn a part using a knee tool	254/263	0	5.9	77.8
20 Recess parts with a recessing tool	255/264	0	5.9	88.9
21 Cut off parts with a vertical slide attachment	256/265	0	11.8	88.9
22 Drill parts with bottoming drills	257/266	0	11.8	88.9
23 (see H-17) Deburr parts	--	0	11.8	88.9
F. Machining Various Materials				
01 (see A-7) Inspect safety areas of machine	--	0	11.8	66.7
02 (E-1) Machine mild steel	258/267	0	17.6	88.9
03 (E-3) Machine aluminum	259/268	0	17.6	88.9

DUTY/TASK	Task/Page Number	Percent Performing		
		Gri	Lat	Scr
04 (E-4) Machine brass	260/269	0	17.6	88.9
05 (E-2) Machine plastics	261/270	0	17.6	77.8
06 (F-2) Machine stainless steels	262/271	0	17.6	88.9
G. Inspecting Parts				
01 (see G-2) Measure with micrometers	--	0	17.6	88.9
02 (see G-3) Measure with calipers	--	0	17.6	88.9
03 (see G-4) Measure with fixed gages	--	0	11.8	77.8
04 (see G-5) Measure with scales	--	0	17.6	88.9
05 (see G-6) Measure using dial indicators	--	0	17.6	77.8
06 (see G-8) Measure with bore gages	--	0	11.8	77.8
07 (see G-10) Measure using an optical comparator	--	0	5.9	88.9
08 (see G-11) Measure with telescoping gages	--	0	5.9	77.8
09 (see G-1) Calibrate micrometers	--	0	0	55.6
10 (see G-13) Inspect parts	--	0	17.6	88.9
H. Maintaining Work Area				
01 (see H-3) Clean work area	--	0	17.6	88.9
02 (see H-1) Change coolant	--	0	11.8	88.9
03 (see H-4) Add coolant when necessary	--	0	11.8	88.9

APPENDIX B

Tools/Equipment/Work Aids by Percent Incumbents Using
(n = 384)

<u>Tools/Equipment/Work Aids</u>	<u>Percent Using</u>
make drum machine	100
hammers	94
allen head wrench	92
wrenches	92
adjustable wrench	90
pliers	90
ball peen hammer	88
files	88
vise grip	88
hand grinder	84
scale	84
screw drivers	84
vises	84
drill	82
micrometer, external	82
tool holder	82
chuck	80
depth micrometer	80
drill press, bench	80
hand drill	80

<u>Tools/Equipment/Work Aids</u>	<u>Percent Using</u>
micrometer: depth	80
micrometer: outside	80
six-inch rule	80
straight edge	80
chisels	78
combination square	78
countersink	78
dial indicator	78
graduated scale	78
socket wrench	78
calipers	76
center punches	76
counterbore	76
hand reamer	76
steel square	76
threading dies	76
boring bar holder	74
boring tool	74
magnetic dial indicator base	74
micrometer, internal	74
tapping head	74
taps	74
feeler gage	72
grinder, bench	72

<u>Tools/Equipment/Work Aids</u>	<u>Percent Using</u>
micrometer: inside	72
protractor	72
tap wrench	72
tool post	72
drill gage	70
drill press, floor type	70
grinding wheels	70
height gage	70
plug gage, plain	70
tool makers vise	70
wing divider	70
angle plate	68
boring head	68
center	68
collet	68
drill grinding attachment	68
gage blocks	68
hacksaw	68
level	68
reamer	68
anvil micrometer	66
arc welder	66
carbide tipped tool bits	66
face plate	66
key type chucks	66

<u>Tools/Equipment/Work Aids</u>	<u>Percent Using</u>
screw & tap extractors	66
surface plate	66
center drills	64
dial caliper	64
height setting gage	64
master square	64
micrometer: blade or slot	64
quick change chucks	64
single point boring tool	64
surface gage	64
V blocks	64
vernier calipers	64
work holding jaws	64
centers	62
clamp: t-slot	62
cut off wheel (grinder)	62
diamond dresser	62
edge finder	62
groove micrometer	62
steady rest	62
angular blocks	60
bench blocks	60
calculator	60
caliper rule	60
clamp: universal	60

<u>Tools/Equipment/Work Aids</u>	<u>Percent Using</u>
collapsible die head	60
comparators, mechanical	60
magnetic blocks	60
magnetic chucks	60
micrometer: thread	60
parallel clamps	60
parallels	60
screw extractor	60
small hole gage	60
steel tape	60
t-square	60
thread chaser	60
collet index fixtures	58
go-no go gage	58
lock grip pliers	58
surface grinder dry	58
swivel vise	58
telescoping gage	58
thread micrometer	58
threading stop	(58)
tool post grinder	58
clamps	56
clamps and straps	56
dial depth micrometer	56
filing machine	56

<u>Tools/Equipment/Work Aids</u>	<u>Percent Using</u>
grinder, surface	56
master precision level	56
taper gage	56
clamp: screw head	54
comparators, electronic	54
direct reading dial vernier	54
fly cutters	54
follower steady rest	54
grinder, cutter	54
grinder, pedestal	54
hardness tester	54
micrometer: disk type	54
scriber	54
square blocks	54
center gage	52
clamp: u-clamp	52
deburring tools	52
drive pin punches	52
hole gages	52
microbore bars and tools	52
micrometer: v-anvil	52
numerical controlled machine	52
pin punches	52
planer gage	52
straight shank reamers	52

<u>Tools/Equipment/Work Aids</u>	<u>Percent Using</u>
taperer attachment	52
telescope gauges	52
thread restorer	52
bevel protractor	50
carbide grinding burrs	50
carriage stop	50
centers with dividing head	50
counterweight feed	50
die hooks	50
dog	50
dressing attachment	50
drill press, radial	50
indexing centers	50
indexing head	50
live center	50
micrometer: point	50
sine bar	50
straight	50
adjustable parallels	48
arbor	48
arbor press	48
center scope	48
center wiggler	48
clamp: double finger	48
cylinder boring bar	48

<u>Tools/Equipment/Work Aids</u>	<u>Percent Using</u>
diamond grinder	48
grinder, carbide	48
hones	48
scraper	48
set up blocks	48
snap gage, plain	48
taper attachment	48
vernier caliper	48
center finder	46
comb carbide scriber & mag ret	46
comb steel step block & clamp	46
drill press, gang	46
hand router	46
keyway cutter	46
magnetic parallels	46
pin vise	46
radius gage	46
tap and reamer aligner	46
tracer	46
adjacent parallels	44
clamp: goose neck	44
collet block chuck	44
cutter grinding attachment	44
drift pins	44
emery cloth	44

<u>Tools/Equipment/Work Aids</u>	<u>Percent Using</u>
eye bolts	44
facing head	44
grinding attachment	44
hermaphrodite calipers	44
honing head	44
honing machine	44
one-two-three blocks	44
tool shapes & grinder	44
tracer attachment	44
tubing micrometer	44
vacuum chucks	44
welding attachment	44
bench sander	42
contour dresser	42
cylindrical grinding attach	42
hydraulic press	42
indicator square	42
measuring wire, thread & gear	42
radius gage set	42
snap gage, thread	42
super sp. three jaw chuck	42
arc cutting	40
automatic screw machine	40
dividing head	40
oxyacetylene torch	40

<u>Tools/Equipment/Work Aids</u>	<u>Percent Using</u>
riser block	40
comparators, air	38
form cutter, multiple flute	38
form cutter, single flute	38
gear cutting machine	38
grinder, O D	38
hold-downs	38
hydraulic feed	38
indexing unit	38
interlocking cutters	38
jacks	38
lathe, toolroom	38
mechanical dividing head	38
slotter	38
tool post turret	38
belt sander	36
cylindrical square	36
divider	36
grinder, cylindrical	36
grinding attachment	36
oil stone hammer	36
orbital sander	36
ring gage, plain	36
rotary table	36
standard measuring machine	36

<u>Tools/Equipment/Work Aids</u>	<u>Percent Using</u>
transfer screws & punches	36
vacuum form	36
bandsaw, vertical cutoff	34
drill press, sensitive	34
key slotter	34
lathe, bench	34
line boring bars	34
magnifying glass	34
sliding protractor	34
universal head	34
bandsaw, horizontal cutoff	32
diamond wheels	32
grinder, I D	32
jig	32
jig borer	32
number & lettering stamps	32
optical dividing head	32
plastic tipped hammer	32
slot grinder	32
spotting tool	32
tapered sleeves	32
tilting table	32
ball bearing parallels	30
grinder, centerless	30
jig borer, vertical	30

<u>Tools/Equipment/Work Aids</u>	<u>Percent Using</u>
optical flats & mono light	30
spade drills	30
spot facers	30
strap wrench	30
template gage	30
auto collimator	28
band saw welder	28
chankshaft grinder	28
end mill	28
fixture	28
grinder, jig	28
horizontal planer	28
inverted tooth cutters	28
jig borer, horizontal	28
lathe, engine	28
magnetic U blocks	28
overhead router	28
rack cutting attachment	28
rawhide mallet hammer	28
rotary head	28
rule holder	28
screw pitch gage	28
shaper, horizontal	28
shaper, horizontal	28
shaper, vertical	28

<u>Tools/Equipment/Work Aids</u>	<u>Percent Using</u>
shaping attachment	28
sleeves	28
turret tailstop	28
carbide mill cutters	26
duplicating head	26
electric farge hammer	26
flexowriter	26
gas welder	26
horizontal head	26
milling cutters	26
milling machine, horizontal	26
punch from grinding fixture	26
t-slot bolt	26
wiggler	26
cavitron (ultrasonic grinder)	24
crankshaft straightener	24
lathe, turret	24
milling machine, vertical	24
profilometer	24
radial arm saw	24
screw pitch gage	24
t-slot cutters	24
valve facing machine	24
flush pin gage	22
forklift	22

<u>Tools/Equipment/Work Aids</u>	<u>Percent Using</u>
lathe madrels	22
loupe	22
morse taper sleeves	22
boring mill, vertical	20
radius dresser	20
right angle head	20
screw kack	20
bandsaw, contour	18
boring mill, horizontal	18
clamps and straps	18
face mill	18
shell mill	18
table saw	18
electric welding	16
milling attachment	16
re-nu-threads inserts	16
right hand	16
slitting saw	16
microscope	14
chain pipe wrench	12
engraving cutter grinder	12
gas cutting	12
high speed head	12
jeweler's saw	12
laps	12

<u>Tools/Equipment/Work Aids</u>	<u>Percent Using</u>
lathe, vertical turret	12
leaf gage	12
milling machine, universal	12
radius turning attachment	12
screw feed attachment	12
slide milling cutters	12
tailstop attachment	12
lathe, tracer	10
mitering attachment	10
turnamatic lathe	10
broaching machines	8
internal spindle	8
quill head	8
shell reamers	8
slab cutters	8
sweeping tool	8
cat head	6
lapping machine	6
slab mill	6
thirty angle guide	6
trammel	6
cherrying head	4
diamond charged mandrel	4
electric furnace	4
gooseneck spring	4

<u>Tools/Equipment/Work Aids</u>	<u>Percent Using</u>
hyperdermic syringe	2
milling machine, profile	2
N.C. tape splicer	2
panel saw	2
panel saw-push button	2
rip fence	2
seat facing machine	2
spring making attachment	2
spring thumb lock	2
wheel crushing attachment	2
wing divider	2
electrical discharge machine	0
gas forge	0
spring thumb lock roller	0
vemco drafting machine	0

APPENDIX C

STATE-OF-THE-ART LITERATURE
Primary Sources

1. Anderson, James and Tatro, Earl E. Shop Theory. McGraw-Hill Book Company, New York. 1974.
2. Brandau, George C. The Development of Individualized Instruction in Vocational Education. Willingboro Public School District, New Jersey. December, 1970.
3. Day, Gerald F. and Herschbach, Dennis K. Resource Guide for Performance Based Machine Shop Instruction. Department of Industrial Education, University of Maryland, College Park, MA. 1977.
4. Department of the Air Force. Handbook for Designers of Instructional Systems. Air Training Command. Washington, D.C. July, 1973.
5. Department of the Air Force. Instructional System Development. Air Training Command. Washington, D.C. December, 1970.
6. Kibbe, Richard R., Neely, John E., Meyer, Roland O., and White, Warren T. Machine Tool Practices. Wiley & Sons, Inc., New York. 1979.
7. Machine Tool Metalworking. Gregg/McGraw-Hill, New York.
8. Specifications and Model Format for Curriculum Products in Vocational Education. Illinois State Board of Education, 1977.
9. United States Air Force. United States Air Force Job Inventory: Machinist Career Ladder. Occupational Survey Branch, Air Training Command. Lackland Air Force Base, Texas. September, 1970.
10. U.S. Department of Labor, Employment and Training Administration. Dictionary of Occupational Titles, 4th Edition. Washington: U.S. Government Printing Office, 1977.
11. U.S. Department of Labor. Occupational Outlook Handbook. 1980-1982 Edition. Washington: U.S. Government Printing Office, 1977.
12. U.S. Department of Labor. Occupational Outlook Quarterly. Fall, 1982.
13. Vocational Machine Shop. Instructional Materials Laboratory, University of Missouri, Columbia, MO. 1979
14. Wasiloff, Tom. Machine Shop Safety. McGraw-Hill Book Company, Gregg/Community College Division, New York. 1974.

APPENDIX D V-TECS MODEL

RESEARCH & DECISION PHASE

Consortium Level
Priority
Determination
Procedures for
V-TECS Product
Development

MODULE 1

State Level
Selection of
Priority for
Development
of V-TECS
Products

MODULE 2-A

Development of
Product Agree-
ment and
Management
Information
Form

MODULE 2-B

Conducting
State-of-the-
Art Research

MODULE 3

CATALOG DEVELOPMENT PHASE

Development of the
Population Report and
Sample Selection List

MODULE 4-A

Development of the
Preliminary
Occupational Inventory

MODULE 4-B

Selection of the
Writing Team

MODULE 4-C

Training of
the Writing
Team and
Finalization
of the
Occupational
Inventory

MODULE 5

Writing of
Performance
Objectives/Guides

MODULE 6-A

Administration
of Survey and
Processing of
Data

MODULE 6-B

Assembling
the
Review Catalog

MODULE 7-A

Assembling the
Product Domain
Report

MODULE 7-B

Review of
Final
Catalog

MODULE 8

324

DISSEMINATION UTILIZATION AND EVALUATION PHASE

Compilation
of Final
Catalog

MODULE 9
TRANSITION
PHASE

Dissemination
of Products

MODULE 10

Evaluation
and Impact
Assessment

MODULE 11

Product Revision

Instructional Materials

Other

Re-entry of Model as Needed

325